ST. LOUIS I CEMETERY, NEW ORLEANS

TRANSITIONAL COMPOSITE METALWORK (19TH-C)

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A THESIS

in

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This thesis is dedicated to
my wife **Denise**.

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ILLUSTRATIONS

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1ST REPUBLIC/DIRECTOIRE/EMPIRE

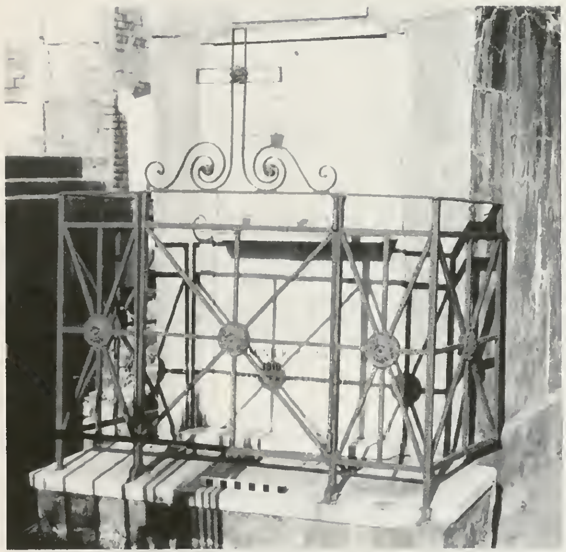
Locoul Tomb # 493 and Labranche #568

Left- Cast iron anthemion. The cross is bent from vandalism. Below left – the cross has been ripped off. Below right - The lecythe or vase was used in ancient times as a container for perfume, becoming a popular funerary offering in Greece around the 5th-C B.C.

Locoul Tomb

Labranche Tomb

Pl. 1

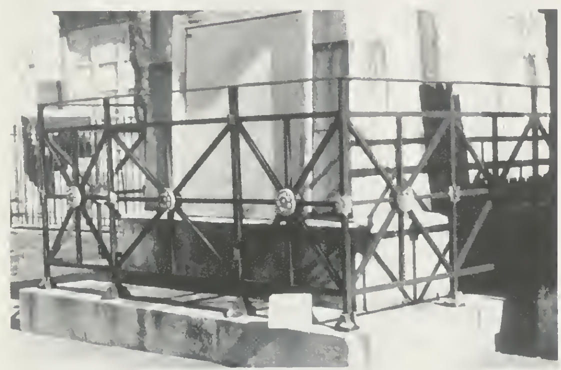


Sabrier Tomb

EMPIRE – CROSSED BARS

Saulet # 46 and Sabrier, #252

Left – Front enclosure. Cross looks like a retrofit. Scrolls originally fabricated asymmetrically. Below- Same general cross-bar configuration with *coupelle* even at the corner posts for a complete enclosure.



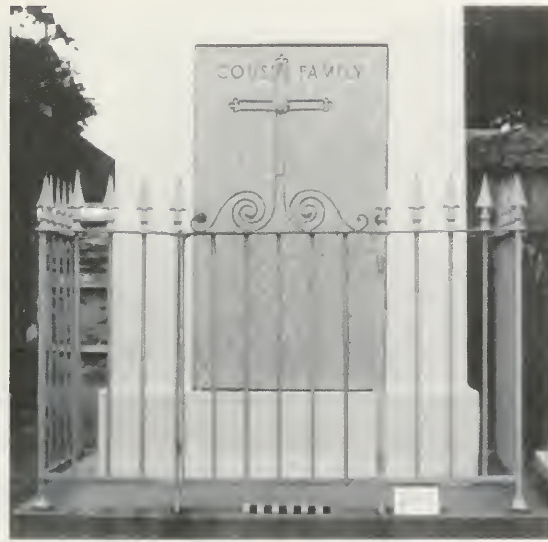
Saulet Tomb

Pl. 2

EMPIRE – VERNACULAR

Cousin Tomb # 243 and 88 others

Left top – example with marble "threshold". Left bottom - a complete allee all of the same type metal work. Below - Front view of a typical enclosure.

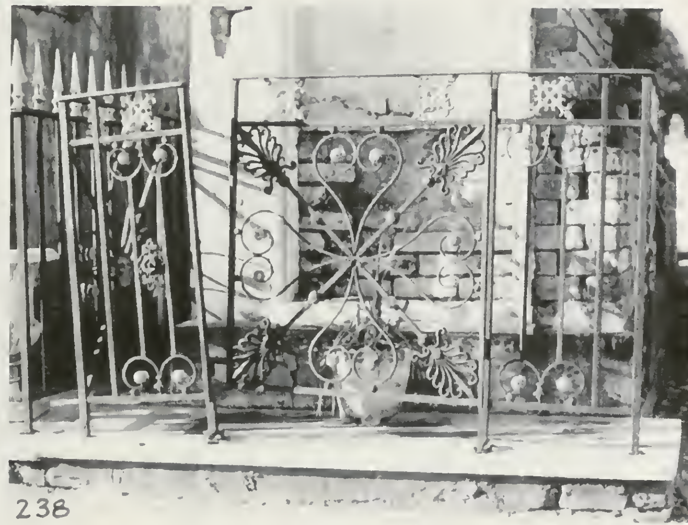


Pl. 3

LOUIS XVI REVIVAL

August # 238, Dubreuil #238

Left top – William LEHEC maker's mark. Left bottom – Dubreuil Tomb #238 by LEHEC. Below - Model for restoration of the Dubreuil enclosure, most likely also by LEHEC



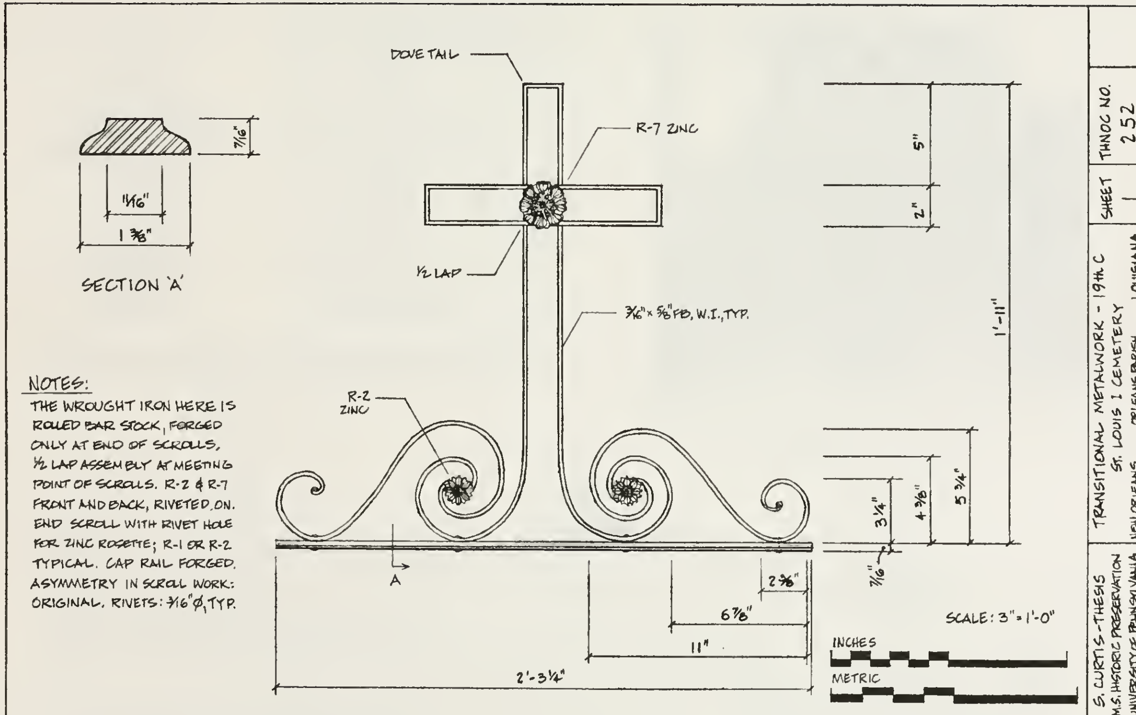
Pl. 4

SPANISH REJA
Bergamini Tomb #12
Left - With cast zinc finials. Below – Cross with cast iron finials. Cast-on zinc rosettes at intersections of wrought iron bars.

Pl. 5

VERNACULAR
Musson Tomb # 193
One of a kind complete enclosure with unique wrought iron cross and cast zinc frieze ornament

Pl. 6



Typical Gate Crest and Cross

Pl. 7

Spanish Influence

FIGURA 66

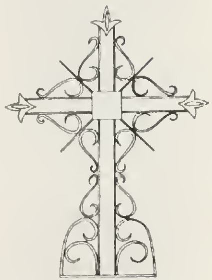
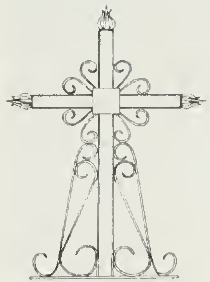
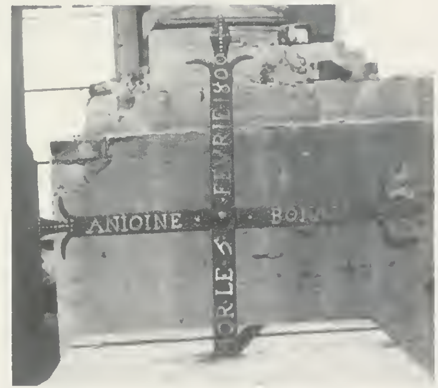


FIGURA 67

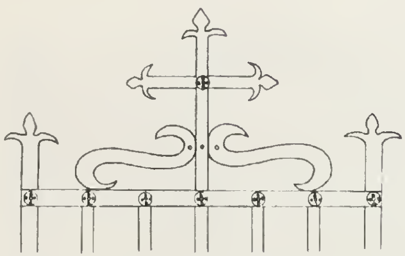


Cemetery Crosses, La Mancha Toledana, Spain
(Casarrubios, p. 325)



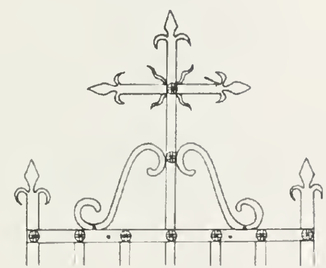
Bonabel Tomb, THNOC # 12
Forged Cross, 1800

FIGURA 10 a



Coronamiento on Window *Reja*
La Mancha Toledana, Spain
(Casarrubios, p. 253)

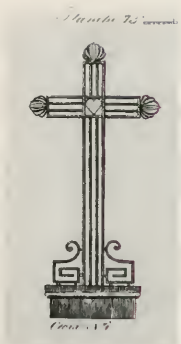
FIGURA 15 c



(Casarrubios, p. 261)

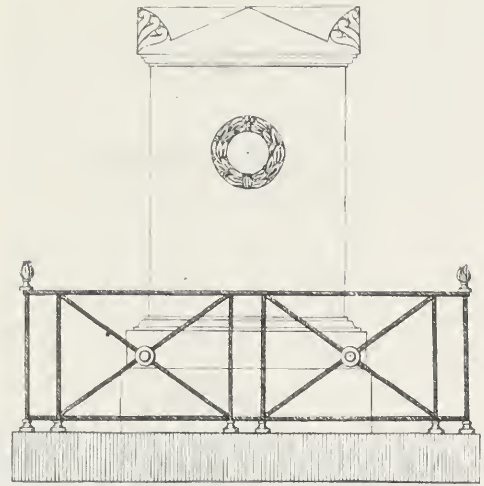
Pl. 8

French Influence



Cemetery Cross
(Berthaux, Pl. 73)

Cross in St. Louis No. 2



Tomb Enclosure
Empire-Crossed Bars
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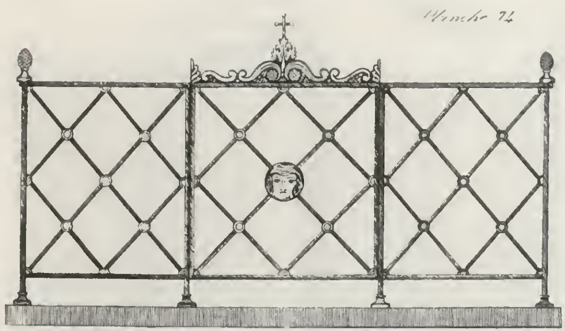
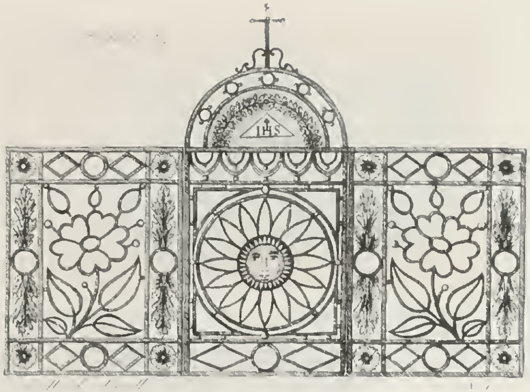
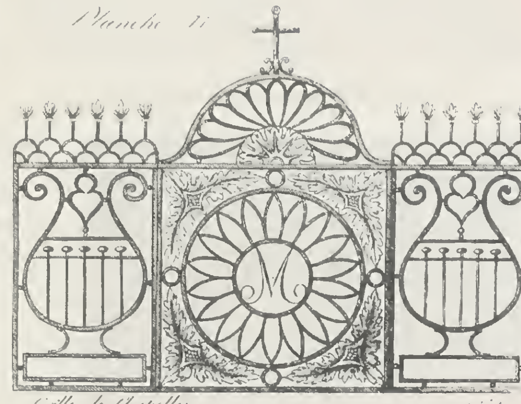


Pl. 9 Enclosure for Cemetery Monuments, (Berthaux, Pl. 74)

French Precedent



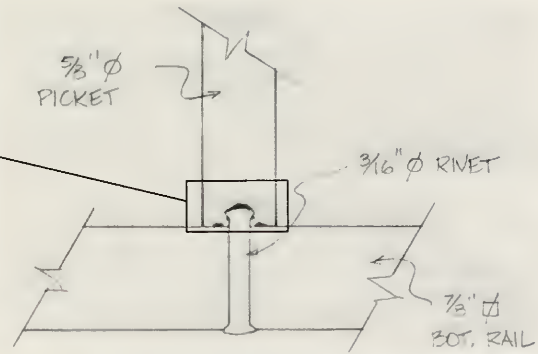
Chapel Grillwork
Tripartite Composition
Berthaux, Pl. 69



Berthaux, Pl. 71

Pl. 10

Metallographic section of picket end with rivet



Section view picket and bottom rail

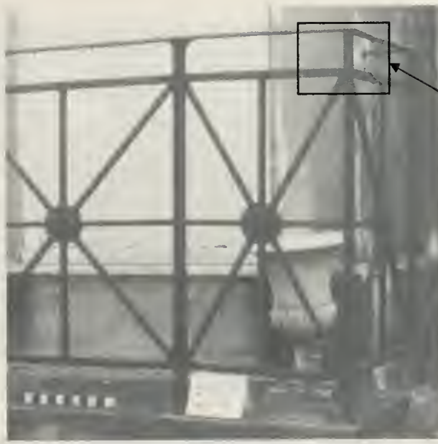
Prisoner Rivet Detail at Picket Base

Marigny Tomb THNOC # 606 - bottom rail, prisoner rivet at intermediate brace

Enlarged section of prisoner rivet

Pl. 11

Rail and Post Joinery Detail



Beauvais Tomb, THNOC #592

Elevation and section views at corner post

Post & Rail joinery with tenon/spline visible

Failed bottom rail assembly

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Remnants of putty hiding a mistake
or recycled material

Vandalized zinc finial revealing
a wrought iron core

Corner finial fastener missing at half lap

Pl. 13

Half Lapped Top Rail At Corner Post

Threaded hole for finial,
typical for corner post finials

Gate Fasteners

Gate hasps with riveted staple and plate

Sliding bolt closure

Vertical sliding latch and hasp combination

Pl. 14

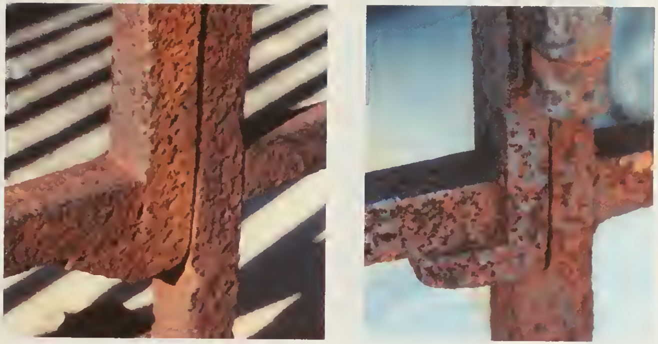
Gate Hinges

Dovetail hinges, opened

Closed dovetail hinge

Two and three knuckle applied and riveted hinges

Pl. 15



Forged angle bracing lower hinge side

Bent angle bracing

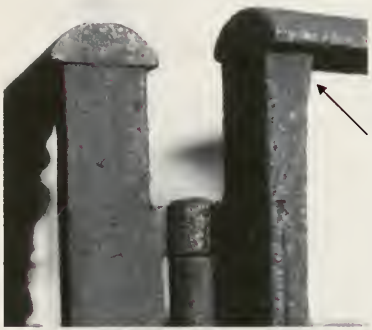
Gate Frame Reinforcement

Forged right angle on gate stile latch side, riveted to rail

Forged right angle bend
with large inside radius

Pl. 16

Forged right angle reinforcement and angled top rail stop



Stile end upset for extra thickness

Gate Stile Reinforcement And Stop

Notched top rail as stop for gate, rivet head visible through rail into stile end

Pl. 17

Post Anchoring And Bracing

Post set in lead missing flange, corrosion caused by lead flange

Lead flange covering anchor hole note typical crack in marble from initial drilling and/or settling

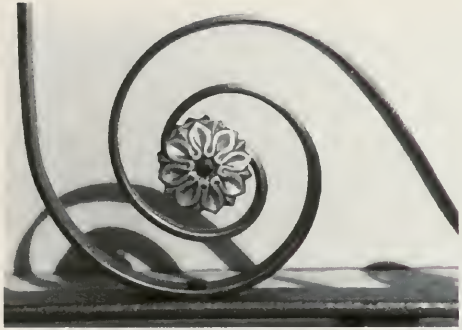
Right angle gate post brace

Post and riveted brace set in lead

Split gate post foot for bracing

Pl. 18

Crest Scroll Connection


Reproduction scroll with zinc rosette riveted through half lap at scroll end


Sabrier Tomb, THNOC # 252 scroll and cross

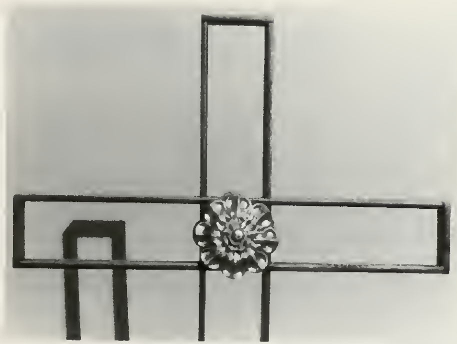

Bergamini Tomb scroll, THNOC #12


Lapping scrolls


One scroll with half lap

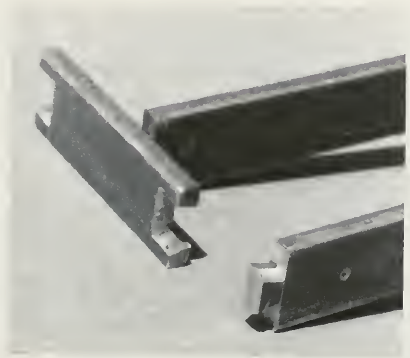
Pl. 19

Cross Dovetail Joinery


Reproduction cross assembled


Pandely Tomb, THNOC# 281


Original cross dovetail


Dovetail cuts before assembly


Dovetail before cold crimping

Pl. 20

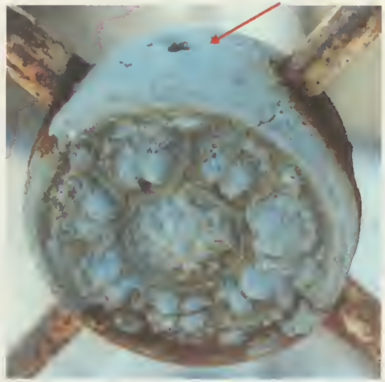
Hub Joinery

Fitted intersection of bars on the Auguste Tomb THNOC # 238

To the left and right are two other bar intersections showing the reliance on the zinc hub for structural integrity. The rear section is cast on first to hold the bars and a decorative rosette/cover plate (*coupelle*) is then riveted on through the middle. This design relied on putty and paint to keep out water infiltration at the seam formed by the two halves.

Pl. 21

Zinc Casting Defects

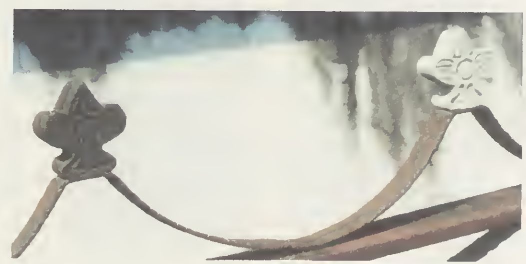


The red arrows show the location of blow holes, which are difficult to avoid when casting zinc in solid forms. The molds must be kept hot to maintain the zinc in a molten state long enough for gases to escape. The photo below shows how a mold normally designed for a greater number of intersecting bars was used. The circle shows where excess zinc was cut off leaving a blow hole. These kinds of defects were masked by filling with painter's putty and the application of several layers of paint.

PL. 22

Possible Cast Iron Patterns

Cast iron versions of many of the zinc ornaments used in St. Louis Cemetery No.1 are found in St. Louis No.2. These elements are often seen in both metals side by side. A reasonable assumption is that cast iron originals were being used as patterns to cast molds for reproducing these ornaments less expensively in zinc.



PL. 23

Molds for Zinc Ornament Spear Point (SP-2)

Cast iron spear point mold with the sprue for pouring the molten zinc, right bottom, and a vent on the opposite side to permit the escape of gases.
Molds courtesy of James Stoyanoff, owner and the Gretna Green Blacksmith Shop

PL. 24

Molds for Zinc Ornament Spear Point (SP-4)

This cast iron mold is double vented and has an iron shim retrofitted to accommodate a smaller diameter picket, (red arrow).

Molds courtesy of James Stoyanoff, owner and the Gretna Green Blacksmith Shop

Pl. 25

Molds for Zinc Ornament Spear Points (SP-5 and SP-6)

SP-6 Only one half of the mold survives

SP-5 with pins

Molds courtesy of James Stoyanoff, owner and the Gretna Green Blacksmith Shop

This mold has no surviving vent or sprue. The molten zinc was poured around the threaded round bar, which also served as an armature for the brittle zinc.

Pl. 26

Molds for Zinc Ornament Finial (F-1)

Cast iron mold with provisions for a threaded round bar at the bottom and a sprue for pouring the molten zinc. No venting is included perhaps because the piece was thin enough not to warrant it. Pins insure the proper register of the two halves of the mold.

Molds courtesy of James Stoyanoff, owner and the Gretna Green Blacksmith Shop

Pl. 27

Molds for Zinc Ornament Rosettes (R-3 and R-5)

R-5 mold is equipped with a sprue and vent. The pin holes mean that it was used with another mold. Only one half survives.

Molds courtesy of James Stoyanoff, owner and the Gretna Green Blacksmith Shop

R-3 mold has only a sprue and must have been backed with a flat plate before pouring when used alone and with another mold when used in a hub application such as on Debreuil tomb THNOC #573

Pl. 28

Molds for Zinc Ornament Rosettes (R-6 and R-7)

R-6 mold with a sample poured in the open mold.

Molds courtesy of James Stoyanoff, owner and the Gretna Green Blacksmith Shop

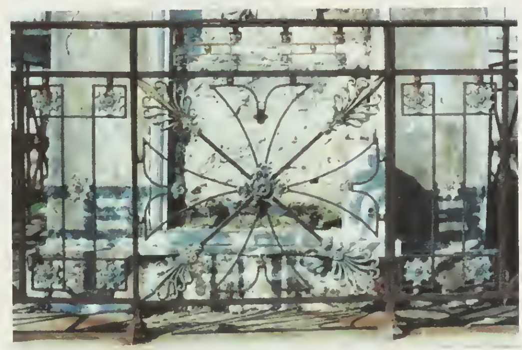
The mold above was used in a hub application not in St, Louis No.1, but is included to show how the casting was cut to accommodate intersecting bars. The large holes could be bolt holes for fastening through the flanges of another half mold for a solid casting.

R-7 mold is a sharper version of R-6 with some additional detail

Pl. 29

Possible LEHEC Works
St. Louis Cemetery No. 2

These three enclosures show a strong similarity in composition, use of motifs and craftsmanship to the Dubreuil tomb THNOC #573 in St. Louis Cemetery No. 1. No maker's mark, however was found to confirm this. These also match many of the elements found in the Perrault tomb THNOC #351, (see Plates 23A, 25A, 26A, 32A, 37A)



Pl. 30

Metalworking Establishments

From the *Crescent City Busines Directory* of 1858
(New Orleans Public Library, Christovich, p. 144)

Advertisement Including Cemetery Tombs
(New Orleans Public Library, Christovich, p. 145)

Pl. 31

INTRODUCTION

Transitional composite metalwork found in the older cemeteries of New Orleans is defined by the combination of technology of manufacture, of metals employed and of styles applied to design. The high incidence of cast zinc decorative elements and their unusual application is what sets this type of metalwork apart. Given the lack of maintenance, the work is also remarkable for the resistance both the zinc and wrought iron have shown to weathering. As the result of abandonment, vandalism and misguided repairs however, the metalwork in the cemetery has been seriously compromised. This thesis documents a type of metalwork seemingly unique to the cemeteries in New Orleans before the information is lost.

The St. Louis Cemetery No.1 is located to the northeast of the French Quarter on Basin Street in New Orleans. It was established under Spanish rule in 1789 because it was thought that decomposing bodies in the St. Peter Street Cemetery in town were contributing to the deadly plagues that were afflicting New Orleans. St. Louis Cemetery No.1 has undergone a steady transformation from a pastoral fenced-in setting to a walled-in "city of the dead" with a dense concentration of above-ground vaults for housing the deceased. These vaults evolved into masonry structures with architectural features varying in design sophistication, materials and craftsmanship. Most are family tombs accommodating one to four vaults. Many of these tombs are ornamented with metalwork protecting the front or completely encircling the tomb.

There are three types of metalwork based on materials and means of manufacture represented in the decorative metalwork in the Cemetery:

Forged Wrought Iron

The earliest metalworking technology, originally brought by the French with the founding of New Orleans in 1718 by Jean Baptiste LeMoyne, Sieur de Bienville, was the hand forging of wrought iron. Forging, or forming heated wrought iron with hammer and anvil, was used to produce the first ironwork in St. Louis Cemetery No.1, primarily surviving in the form of simple crosses (plate 8). Forging permitted the change in the section of the wrought iron bar stock and the use of other basic blacksmithing techniques such as hot splitting, upsetting, swaging and forge welding.

Transitional Composite Metalwork

Wrought iron bar stock and cast iron production started in New Orleans by the 1820s. England, Sweden and other European and American manufacturers supplied both raw material and finished products. Some small decorative cast iron elements seem to have found their way into the designs of the cemetery work early in the nineteenth century.[1] These were mostly supplanted by the 1850s, if not sooner, with finer detailed and less expensive decorative zinc elements. Zinc ornamentation was cast separately or often directly on a wrought iron structure, sometimes doubling as clamps holding the fabric together. This transitional period of expression in metal saw the slow demise of hand

[1] Ann M. Masson and Lydia H. Schmaltz, *Cast Iron in the Crescent City*, New Orleans: The Louisiana Landmarks Society, 1995. p. 3

forging. Wrought iron bar stock was available commercially in any dimension and was increasingly being used "as-is" without change in section. For curved linear shapes, the stock was formed hot, possibly with the use of jigs, and all the parts put together or fabricated with assemblages often mimicking those used in woodwork, such as the dovetail and mortise and tenon (plates 12, 20).

Cast Iron

Cast iron was manufactured by a team of specialists starting with designers and pattern makers followed by foundry men who execute the work by pouring molten iron into molds, the resulting castings being cleaned up by finishers. By the 1850s cast iron panels were taking the place of fabricated work. The panels were first mounted in wrought iron frames. As the technology became more sophisticated in the 1870s and 80s, manufacturers developed completely cast systems that included posts and gate doors. Their intricate patterns came to dominate the metalwork in the cemetery, in part because they were less expensive than the more labor-intensive traditional metalwork.

The aim of this thesis is to document the *transitional composite metalwork* in the St. Louis Cemetery No.1 and to provide information on the context in which it developed. This is a study of material culture, using objects as primary data.

The discussion that follows is an initial effort at addressing the seven areas of interest listed below and includes an attempt at identifying areas that may warrant additional research:

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

1. The period of manufacture;
2. The typology;
3. The identification, provenance and availability of the raw materials;
4. The identification of designers and fabricators;
5. The means of production, or the tools and techniques of manufacture;
6. The influences which contributed to the design, style and means of manufacture;
7. The social and economic context in which the commissions were carried out;

NOTE: Within the primary type of *transitional composite metalwork* in the cemetery, six subtypes have been further identified. Photographic representations of samples of each subtype appear first for reference in the preceding section on illustrations. A written description of each type is included in Chapter 2 covering typology.

Chapter 1. DATING

There is little available documentary information to accurately date the transitional metalwork in the cemetery. All metalwork was apparently contracted separately from the masonry, and the Archdiocese of New Orleans does not retain records of this type of transaction. The first dates on the tombs are not a reliable indication of when the metalwork was installed. Existing inscribed tablets may not be the originals. Metalwork was also clearly retrofitted in many cases, meaning that the first date for the tomb may not correspond to the installation of the metalwork.[2]

Stylistically speaking, much of the work is representative of the second decade of the nineteenth century and the French Empire style. Typical motifs found in the finer furnishings of the period include animal paw terminals, the lyre, lecythe or vase, arrow, spear points, stylized daisy, acanthus leaf and swan motifs.[3] All of these except for the last are represented in the cemetery metalwork. The use of these motifs may well have been carried further into the nineteenth century than they would have in France. On the other hand, work incorporating the greatest degree of forged elements with curvilinear designs harks back to pre-revolutionary French styles, but only in

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[2] Local Architectural Historian, Ann Masson acknowledges the difficulty of establishing meaningful dates. However, she suggests that tablet information and funeral records could be correlated and that along with other general social, family and physical data, the dates for construction, renovation and enlargement of the tombs could be established. This could help date the ironwork and is being attempted with a selection of tombs in the cemetery.

[3] Olivier Quéant, ed., *Styles de France : Meubles et Ensembles de 1610 à 1920*, Paris : Les Publications de France, post 1953, p.127 and Phillipe Faure, La Ferronnerie d'Art Dans l'Architecture des Origines a Nos Jours :1792-1895, Tome 3, Dijon, France : Centre Régional de Documentation Pédagogique de l'Académie de Dijon. 1980, p. 1

inspiration. Dating on the basis of style is useful in providing a *terminus ante quem*, or a date before which a certain work could not have existed.[4]

Some bracketing for dating may be possible through analysis of materials and technology employed when data exists on the chronology of the availability of each. As with style, this is an indirect, imprecise method of dating with its share of pitfalls.

Combing through period descriptions of the cemetery might reveal some information on the metalwork associated with a date. One visitor's description of the cemetery as late as 1845 was notable for not making any mention of metalwork:

> The cemetery in which I now stand looks as if modeled after a growing city. The tombs have an air of freshness bout them which betrays their newness – nothing seems of yesterday – the peculiarity of their structure, their close juxtaposition filling the plats like blocks of building, the well-graveled paths between.[5]

[4] Additional research is required in order to more closely bracket the transitional metalwork in St. Louis No. 1. With more firm dates it will be possible to establish the current style for the time period and what was considered "retro" in Europe and in America. Conditions local to New Orleans will need to be considered as they effected the implementation of current styles of the period.

[5] Ann M. Masson, Père La Chaise and New Orleans Cemeteries, In *Southern Quarterly* 31, No. 2, Winter 1993, p. 88 - as quoted from Henry Didimus, *New Orleans as I Found It*, New York: Harper, 1845, p. 43

Chapter 2. TYPOLOGY

The decorative arts are often studied through classification according to generally recognized categories of expression. Stylistic expression is linked to location and a specific time period when it first comes into being and until it is largely supplanted by a new expression. A style can appear interpreted or copied in a different location and a later time period, but never before its first manifestation. The designation of a style or expression is used here along with method of manufacture to organize and set apart distinctive types for further investigation:[6]

TYPES OF TRANSITIONAL COMPOSITE METALWORK

St. Louis Cemetery No.1[7]

First Republic/Directoire/Empire

Manufacture: forged, fabricated, cast detail

Elements/Motifs: diamond shape with curved sides, Maltese cross, anthemion or "*palmette*", lotus flower finial/picket point, stylized daisy rosette, *coupelle moulée* (disk or hub with high relief carving), lyre, animal paws for post flanges, lecythe or vase, arrow motifs, Roman spear points, ball spacers, molded hand rail, overlapping scrolls

[6] A tentative typology was devised for a survey conducted under the auspices of the University of Pennsylvania 2001-02 historic preservation studio on St. Louis Cemetery No.1 without the benefit of stylistic analysis. Most of the data collected during the project is related to condition.

[7] Note: All tomb reference numbers are those of The Historic New Orleans Collection, (THNOC); See Appendix A – Catalog of Ornament for the materials used.

Composition: weighted at the bottom with a separate panel or a panel occupying the full space between bottom rail and handrail

Expression: linear, geometric, spare, heavy in symbolism

Examples: Perrilliat #162, Perrault # 351, Locoul #493, Brown/Fernandez/Labranche #568, Crescioni #1500

Count: 5

Empire – Crossed bars

Manufacture: fabricated, cast detail

Elements/Motifs: cross bars, *coupelle moulée* at intersections, molded hand rail separate from top rail.

Composition: rectangular panels with cross bars accented at the intersection with a *coupelle moulée*, empty frieze defined by the space between the horizontal lines of the hand rail and top rail

Expression: straight lined, classical Roman simplicity, strength

Examples: Saulet # 46, Eugenie #57, Bright/Hincks #126, Hackney #152, Sabrier #252, LeBaron #302, Brandt #363, Bodin #443, Aldige/Serre #451, Antee/Esnard #506, Canon #569, Beauvais #592, No name #602

Count: 12

Empire – Vernacular

Manufacture: fabricated, cast detail

Elements/Motifs: simple round pickets with cast Roman spear points set in top and bottom rails

Composition: regularly spaced spears guarding the tomb

Expression: austere, defensive, militaristic

Examples: Harang #16, Rouelle #21, Bermudez #35, Magnier #160, Boulet/Veau #235, Cousin #243, Pandely #281, Morphy #364, Lacombe #564, etc.

Count: 89

Louis XVI Revival

Manufacture: forged, fabricated, cast detail

Elements/Motifs: floral and leaf motifs in imitation of repoussé sheet metal work, ball spacers, fleur-de-lis, scroll work, diamond shapes

Composition: panels with the symmetric alternation of straight and curved forms outlined in thin bars with decorative terminals, molded hand rail separate from top rail forming a frieze filled with decorative elements

Expression: light, airy, fine flowing curves contrasted with straight lines, busy, ambiguous

Examples: Auguste #238, Dubreuil, #573

Count: 2

Spanish Reja

Manufacture: fabricated, cast detail

Elements/Motifs: flat bar grille work with cast rosettes at intersections, multiple varied finials on top rail, (pine cone, acanthus and lotus)

Composition: regularly spaced vertical and horizontal flat bars forming regular square openings softened by rosettes at the intersections, thin line of light finials along top of a visually much more massive screen, vernacular

Expression: defensive, naïve application of finials, disjointed

Examples: Bergamini #12, No name #158, No name #450, Kahn #2004

Count: 4

Vernacular

Manufacture: fabricated, cast detail

Elements/Motifs: large finials in the form of urns, unique stylized flower motif with wrought iron armature, rosette type R-7 used as hub at the intersection of the bars in the front frieze, half round handrail

Composition: tall, capped with a narrow frieze all around filled with cross bars in front and unique stylized flowers on the sides and back, corners emphasized with especially large finials, regularly spaced round bars for infill under the frieze, vernacular

Expression: top heavy, individualistic, sturdy

Example: Musson #193

Count: 1

Common Characteristics

What all the *transitional composite metalwork* has in common is the combination of metals used: primarily wrought iron and zinc, with some lead and cast iron. Also characteristic of the work is the coexistence of a variety of working methods in contrast to earlier purely forged wrought iron and the later mostly cast iron work.

The cross and crest ornamentation on the gates of the enclosures in almost all cases are adjunct elements. They exist independently of the panel style and are composed of a combination of forged scrolls, fabricated crosses and cast zinc decoration (plates 1, 2, 3, 5, 6, 7). In other words, similar cross and crest configurations can be found on the different types described above almost as a standard retrofit even though their dimensions and stock sections all vary. The fact that similar crosses can be found in a variety of the subtypes of the transitional composite metalwork would indicate that they were either retrofitted or that this class of metalwork was all made in roughly the same period of time when the cross-crest detail was in vogue.

In all cases the wrought iron bar stock frames are fabricated with mortise and tenon assemblages (plates 11). Limited forging is evident in most cases at gate stile ends and gateposts to reinforce corners (plates 16, 17, 18).

Designation of Style

Typology for the transitional metalwork in the cemetery may best be established by a stylistic designation in combination with a predominant method of

manufacture. For example, some work displays more hot work with correspondingly more curvilinear forms suggesting an earlier style, (Louis XVI), coupled with an earlier technology, (forging).

The art historian and theorist, Meyer Shapiro has offered this approach to defining style:

> Although there is no established system of analysis and writers will stress one or another aspect according to their viewpoint or problem, in general the description of a style refers to three aspects of art: form elements or motifs, form relationships, and qualities (including an all-over quality which we may call the "expression").[8]

He goes on to say that *technique, subject matter, and material* may be characteristic of certain groups of works and will sometimes be included in definitions, but warns that they are often not as specific to the art of a period as qualitative criteria. The different types of transitional metalwork have been characterized above in terms of their primary mode of manufacture, their component parts including motifs, the composition of the whole and the overall expression of the work.

Classic French styles are primarily employed here because in this type of metalwork they appear to be the most relevant from an analysis of the motifs, the form relationships or composition, subject matter, technique, as well as an overall expression.[9] Many of the people involved in the design and construction of the tombs and ironwork have been documented as being French or of French extraction,

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[8] Mayer Shapiro, *Theory and Philosophy of Art: Style, Artist, and Society*, N.Y.: George Braziller, 1994, p. 54

[9] I am indebted to Ann Masson for opening my eyes to key signs of European stylistic influences.

including the architect de Pouilly (1804-1875) and the builder he used most for the construction of the tombs of his design, P.H. Monsseaux.[10]

Florville Foy (1820-1903) was a master marble cutter, the son of a French marble cutter and a free woman of color. He spent time apprenticing in France and later built his father's business into a very successful enterprise supplying stone work for the cemeteries in New Orleans based in a French craft tradition.[11]

The transitional metalwork in St. Louis Cemetery No.1 designated "Louis XVI Revival" (Plate 4), has been identified through a maker's mark as being the product of a French blacksmith possibly from Normandy or Brittany by the name of Lehec.[12] This represents another direct association with France, but this is not to say that the authors of the cemetery metalwork were predominantly French, nor were they impervious to cross cultural influences. Except for Lehec's work, conclusive authorship has yet to be determined.

The stylistic designations do not pretend to describe a pure expression of the style and do not indicate a period of fabrication corresponding to the established time period for the style. The period for Louis XVI style ironwork, for example, has been defined as originally existing between 1775 and 1793.[13] None of the metalwork in the cemetery is of such an early date. When the cemetery was established in 1789 under the Spanish occupation of New Orleans, available metalworking technology was

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[10] Mary Louise Christovich, Edit. *New Orleans Architecture, Vol. III: The Cemeteries*, Gretna, LA: Pelican Publishing Co., 1997, p. 79

[11] Patricia Brady, Florville Foy, F. M. C.: Master Marble Cutter and Tomb Builder. In *The Southern Quarterly: A Journal of the Arts in the South*, Alfred E. Lemmon, ed.,Vol. XXXI, No. 2, Winter 1993

[12] U. S. Federal Census of 1860 for New Orleans, Louisiana and for free inhabitants in the 2nd Ward, 1st District, Orleans Parish, .June 25, 1860, Samuel W. Slater, Assistant Marshal

[13] Phillipe Faure, *La Ferronnerie d'Art Dans l'Architecture des Origines a Nos Jours : De Louis XIV à Louis XVI,* Tome 2, Paris : Editons Eyrolles, 1978, pp. 61-80

limited to wrought iron techniques. Zinc was probably not available until the 1820s.[14] The appearance of elements of the Louis XVI style is related to the later revival of seventeenth and eighteenth century styles and the corresponding techniques of forging in France during the Second Empire, 1850-1870. In regard to purity of style, even Lehec's work displays a mixture of stylistic elements. The lion's paw gate post flange is a typical Directoire/Empire motif found on the Dubreuil tomb, but the light curved forms he uses are an unmistakably eighteenth century, (or Second Empire revival) expression.

A counter current of "picturesque eclecticism" starting in the 1840s and championed in America by Andrew Jackson Downing was a response to the inflexible Greek Revival architecture and landscapes.[15] This quite deliberate and generalized reaction to classical strictures may possibly have influenced the eclectic use of ornament by the designers and fabricators of the transitional metalwork in the cemetery. It at least set up a climate of tolerance for an inexpert, less conscious combination of motifs. For reasons that will be discussed later, it is possible that the French community of New Orleans was only marginally affected by currents of taste occurring elsewhere in the United States. It would be interesting, though difficult, to determine what role simple availability of manufactured ornament may also have played in the composition of the metal work.

What is designated the "Empire – Crossed bars" comes from a classically inspired design (plate 2). The archeological movement of the mid-eighteenth century

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[14] See later discussion in Chapter 3, Materials Identification, Provenance and Availability
[15] Vincent Scully, *American Architecture and Urbanism*, New York: Henry Holt and Co., 1988, p. 87-88

focusing on the rediscovery of Roman antiquities uncovered the chancel, or paleochristian church choir enclosure: a low roman balustrade in stone with the cross-bar motif.[16] This became a popular design in France applied to tomb enclosures starting in 1804 with the opening of the Père Lachaise cemetery in Paris.[17]

The revolution in France caused a dramatic rupture with the past, leading to great economic turmoil, including the disbanding of the traditional guild system and trade corporations.[18] Initially, the few who had money to spend on artistic works did not dare to for fear of being singled out as "privileged". Eventually a merchant class with means was allowed to exercise their purchasing power. These "bourgeois" were for the most part insensitive to quality. As "nouveaux riches", they were only interested in appearances and ostentation. While the artist craftsmen gained a great degree of freedom, they had lost their discerning clientèle.[19]

Napoleon worked to revive industry and commerce in France, but went on to initiate a campaign of wars that spoiled the export market and hampered the importation of raw materials. As a result, the market for luxuries had to wait until well after he was removed from power in 1815. As late as the 1830s, after the restoration, the monarchy found it politically expedient to maintain a frugal posture.[20]

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[16] Phillipe Faure, *La Ferronnerie d'Art Dans l'Architecture des Origines a Nos Jours : 1792-1895*, Tome 3, Dijon, France : Centre Régional de Documentation Pédagogique de l'Académie de Dijon. 1980, p. 1
[17] Frederick Brown, *Père Lachaise: Elysium as Real Estate*, New York: The Viking Press 1973. The book contains a series of photographs showing the Roman chancel design in use.
[18] J.C. Wardell-Yerburgh, *La Passion des Antiquités*, Paris : Gründ, 1975, p. 80
[19] Pierre Francastel, *Le Style Empire: Du Directoire à la Restauration*, Paris : Librairie Larousse, 1939, pp. 7-8
[20] Francastel, pp. 6-7

The French art historian, Pierre Francastel, has characterized the Imperial Period as one of "poverty and artificial luxury". The essence of the period never quite waned and was only reinforced with the coming of the industrial revolution. The novelties presented at expositions held at the time featured works in substitute materials, such as jewels of steel, works in cardboard, cast iron, wood veneer and metal plating.[21] From the beginning, zinc ornament was understood to be an inexpensive substitute for more valuable materials. It was coated to imitate bronze by electroplating copper or painted and later sandblasted to imitate stone. The artifice of zinc was tailor-made for the times, sustaining a market through much of the nineteenth century and lasting into the twentieth-century when it was employed as a material for monuments.[22]

Occurring simultaneously with the waning of the tradition of pursuit of excellence in the trades was the onslaught of the machine age and the fascination with methods of mass production. During this period "the artisan ceased being an artist to become an industrialist".[23] The use of zinc with its ability to capture fine detail from a mold along with cast iron, helped to popularize opulent ornamentation, which prior to the revolution had been the exclusive right of the nobility.

Neo-classicism grew out of Western culture's fascination with antiquity starting with archeological findings in the mid-eighteenth century. Early in the process of

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[21] Francastel, p. 72
[22] This was true for most of Europe and North America. However, a recent survey of zinc monuments in Europe by Carol Grissom, Chief Objects Conservator, Smithsonian Institute, revealed few surviving works in zinc in France. It seems that most of the works in zinc in the late nineteenth century in France were reproductions of sculpture for interior decoration. Additional research is required to determine the extent of use of zinc in French ironwork. Period French catalogs mostly make reference to the use of cast iron as the substitute material of choice for applied ornamentation. Cast iron was used to mimic *repoussé* sheet metal ornament, but also made new forms of ornamentation possible. See Appendix A, a catalog of ornament used in the transitional metalwork in St. Louis Cemetery No.1.
[23] Francastel, p. 8

rediscovery, the distinctions between Greek, Etruscan and Egyptian art became confused. Napoleon's Egyptian campaign was a scientific mission and an "annexation of new territories of history".[24] Things Egyptian became the craze in Paris and Egyptian Revival was associated with the Imperial style.[25]

Because of Napoleon's nepotism and the installation of close relations on different thrones bordering the French empire, the Empire style was assimilated almost instantaneously. England, Russia, Austria and America would soon acknowledge once more "the natural consequence of the superiority of French art".[26]

With the publication of their work on interior decoration, Percier and Fontaine, the voice of official art in France, brought together all the artistic currents beginning with the *Ancient Régime* up to the Restoration. They laid the groundwork for Le Brun and the academic doctrine by holding up the standard of the classics as the "power of reason" and the ultimate expression in architecture, ornament and furnishings.[27] Percier's work would indirectly contribute to the creation of the Regency style in England through the design interpretations of Thomas Hope.[28]

Napoleon's influence on the arts is considerable. He imposed on artists a noble, cold and imperial expression emphasizing power over intimacy. Napoleon's

[24] Francastel, p. 12
[25] The sphinx, for example, was a favored subject of the Empire style. It was interpreted and produced as a whole anthropomorphic detail or elements were extracted, such as the lion's paw in furniture and in other applications. See the catalog of ornament following.
[26] Wardell-Yerburgh, p.80
[27] Francastel, p. 13-14
[28] Wardell-Yerburgh, p.81

contribution was one of tone, the exterior imposition of will and power, and not the *forms* typically associated with the movement.[29]

In St. Louis Cemetery No.1, the "First Republic/Directoire/Empire" type designation represents the literal ostentatious expression of the most obvious symbolism of antiquity and imperial power (plate 1). In reaction and in contrast, the Louis the XVI type of metalwork is a throwback, a confused expression reflecting the nostalgic pre-revolutionary past.

Napoleon's "Imperial tone" is most felt in the very austere, purely classical "Roman- Crossed Bars" type of enclosure. On the other hand, it is perhaps most eloquently expressed in the simple, direct vernacular of the martial alignment of spears in the work designated "Empire-Vernacular" (plate 3). The affection that the French community in New Orleans had for Bonaparte was well known despite his sale of the French colony to the Americans. After Napoleon had been exiled to St. Helena, a wealthy group of New Orleanians purchased a ship in 1821 to rescue him and bring him back to New Orleans. He died just days before the ship could set sail.[30] The battery of spears found around the largest percentage of tombs in the cemetery could be viewed as the final statement by the Emperor's admirers of the belief that his guard and thus French culture would persist in the face of American Cultural Imperialism.[31]

Traditionally, the study of art and architecture was limited to those buildings and artistic works that were understood to represent the highest form of expression within

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[29] Francastel, p. 13-14

[30] Joan B. Garvey and Mary Lou Widmer, *Beautiful Crescent: a History of New Orleans*, (New Orleans: Garmer Press, Inc., 9th Ed.), 1998, p. 74

[31] See the following catalog of ornament and the representation of Bonaparte's tomb in St. Helena as a possible precedent for the Empire -Vernacular type in the cemetery.

a given period and cultural context. Its focus has been on issues of aesthetics or the choice of materials and the rational laws used to govern the interaction of such abstract concepts of style, volume, form and scale and their attendant symbolism.

The label "vernacular architecture" has been applied to "home grown" construction or the architecture of "common usage and communication,"[32] unaffected by scholarly aesthetics and most often associated with buildings of every day use such as agricultural buildings, warehouses and simple dwellings, as opposed to monuments, mansions, government buildings and places of worship usually involving professional design services. In recent years, increasing social inclusiveness has led to the study of vernacular buildings' contribution to a social history that had largely been ignored.

The language of any type of artistic work has very complex origins affected by political, social and economic forces. This discussion of the meaning of "vernacular" has as much to do with the definition of a type of work as with explaining an approach to a particularly intricate subject.[33] A more comprehensive understanding of the factors affecting art demands a multi-disciplinary evaluation. All artistic works can now be scrutinized for a variety of aesthetic influences as well as such factors as social divisions, public regulations, availability of materials, level of craftsmanship and existing technology. As Henry Glassie, the pioneer in the study of vernacular architecture wrote: "The study of vernacular architecture, through its urge toward the

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[32] Bernard Herman, *Architecture and Rural Life in Central Delaware*, Knoxville, TN: The University of Tennessee Press, 1987, p. 13

[33] Thomas Carter and Bernard L. Herman, *Perspectives in Vernacular Architecture, IV*, Columbia, Missouri: University of Missouri Press, 1991, p. 2-3

comprehensive, accommodates cultural diversity. It welcomes the neglected into study in order to acknowledge the reality of difference and conflict."[34]

Vernacular expression began as a general classification of type but has evolved to define the common language of art and architecture of a given period and context. Setting art in its context means considering the broadest spectrum of artistic works across social divisions and functions and recognizing a community's shared cultural language. Vernacular expression is the result of the fusion of outside influences with local realities and sensibilities affecting all artistic works within the local context.

Most of the transitional composite metalwork in the cemetery is a vernacular expression. It is "composite" not only in the sense of the blend of materials and methods used, but also in terms of the combination of cultural sensibilities that were incorporated. The compositions may have also been determined by economic factors affecting what decorative elements were available to the fabricator for assembly. The cast zinc and cast iron decorative elements are limited in number. With few exceptions, the patterns are applied across all types of work. This suggests that the different shops doing work in the cemetery either had their own molds for the same castings, were purchasing from a distributor or were borrowing the molds or buying the castings from other shops or distributors.[35] No information has yet surfaced indicating whether the patterns and molds for the decorations were made in New Orleans or imported from elsewhere. Some very similar, if not identical, cast elements

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[34] Henry Glassie, *VernacularArchitecture*, Philadelphia: Material Culture, Bloomington and Indianapolis: Indianapolis University Press, 2000, p. 20

[35] Another possibility is that local shops were using commercially available cast iron ornament as patterns to make their own molds for less expensive casting in zinc, see plate 23.

exist in the Père Lachaise Cemetery in Paris, notably the *coupelle moulée*, (disc with a flower or shield design in relief, Plates 29A and 30A), serving as a hub for intersecting bars[36] and finials such as the common pine cone (plate 10A).[37]

Much has been written in recent years on the subject of vernacular architecture, applicable to artistic conception in general. Roger Scruton, author of *The Classical Vernacular*, offers this definition, which is relevant to the conception of the metalwork in St. Louis Cemetery No.1:

> ...the architecture of the ordinary builder, the person with neither pretension nor claim to genius, who has nevertheless availed himself of patterns and principles through which to exercise his taste, to please his client, and to make lasting decisions as to what is right and wrong.[38]

Scruton recognizes and highlights the presence of formal elements in much of the eighteenth and nineteenth century vernacular architecture and distinguishes this work from the rest by classifying it as "classical vernacular".

The "Empire – Vernacular" (plate 3), designation is based on the one salient feature of the Empire style, the classic Roman spear point, which is used in a fashion suggesting a sentinel of soldiers protecting the tomb with regularly spaced spear points aiming skyward (plate 1A). The lack of design sophistication, the commonness of this type of metalwork and its association with simple tombs constructed in local materials

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[36] Faure, p. 17

[37] Brown, photographs of tomb ironwork. It has recently been confirmed by Carol Grissom that the applied ornament is not cast in zinc.

[38] Roger Scruton, *The Classical Vernacular: Architectural Principles in an Age of Nihilism*, Manchester, England: Carcanet Press Ltd., 1994, p. 15

makes it a "vernacular" expression. Other types have more formal characteristics beyond just the use of classical motifs, extending to form and composition; these could be termed "classical vernacular", (First Republic/Directoire/Empire, plate 1 and Empire-Crossed Bars, plate 2).

The French precedent in most interpretations of New Orleans art has dominated the Spanish influence. Spanish tradition is nevertheless strongly present not only in the mode of above-ground burial, but also possibly in at least two manifestations in the cemetery metalwork. Just as the French prototype of the chapel rail can be interpreted as a means of controlling access to the chapel of the family tomb (plate 9, 10), the typical Spanish form of the window grill or *reja*, shares the function of protection, but extends its reference to the home (plate 8).

While the French and Spanish share a common Catholic heritage, the exterior expression of their beliefs has taken different forms. It is interesting to note a possible cross-fertilization of the two approaches. The amendment of the basic French chapel rail model (plate 10) and its diminutive cross by much larger crosses could be the influence of a more expansive Spanish religious expression. The precedent exists in the region called the Mancha Toledana, south and east of Madrid, Spain, which includes the provinces of Albacete, Ciudad Real, Cuenca and Toledo. Here the form of *coronamientos* or crowning on *rejas* (plate 8), is similar to the crestings on the enclosure gates in St. Louis Cemetery No.1.[39] They also match exactly the earliest forged metal work in the cemetery installed during the period of Spanish occupation,

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[39] Consolación Gonzalez Cassarrubios, *La Artesania del Hierro en la Mancha Toledana*, Toledo, España: Diputación Provincial de Toledo, 1996, pp. 244-268

(see the Bonabel tomb cross, Plate 8). The Spanish were more apt to integrate their religion into the home and would have naturally transferred this sensitivity to the site of their final resting place where the protection afforded by the cross was no less obligatory. Variations of these cross designs are not coincidentally present in the cemeteries of the region (plate 8).[40]

An easy attribution of origin can be made for the type of enclosure best represented by the Bergamini tomb THNOC #12 (plate 5). The mode of grillwork of equally spaced vertical and horizontal bars forming a pattern of squares is typical of the *reja* "*retícula*", (reticular: in the form of a net)[41] or "*celosía*", (lattice), producing a screening effect that allowed looking *out* from inside while obstructing the view *in* from the exterior. This form of *reja*, although usually executed in square or round bars pierced and threaded through forming intersections, was of a type commonly produced in the region of La Mancha.[42]

While the **"Spanish Reja"** type designation is not a style, it does indicate Spanish influence. The blend of influences that is the heritage of New Orleans explains the sense that the crest and cross elements are disjointed afterthoughts or super-impositions since they have been placed on so many of the enclosure gates irrespective of style.

The last category simply named **"Vernacular"** is for one enclosure: the Musson tomb #193, which is an enigma (Plate 6). Not only is it one of a kind, but the

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[40] Gonzalez Cassarrubios, pp. 319-326
[41] Webster's College Dictionary, New York : Random House, Inc. 1991, p.1149
[42] Gonzalez Cassarrubios, pp. 29 and 217-236 and Monique de Fayet, *Ferronnerie Espagnole*, Paris: Editions Charles Massin, 1969, Pl. 60

design has no clear predominant stylistic inspiration. The collection of rays in wrought iron emanating from the intersection of the cross is a motif that could be either French or Spanish. One zinc rosette employed, (R-7, Plate 20A), is common in the cemetery, suggesting that the ornament is roughly contemporary with the other metalwork. Another unique zinc detail used in the frieze is of mysterious origin (plate 38A).[43]

It should be pointed out that the next movement in the arts, the Gothic Revival came into being in the early 1830s in France, promoted by Eugène Viollet-le-Duc and Victor Hugo. Works in the Gothic Revival mode were exhibited and admired at the Paris Exhibition of 1855. No obvious Gothic influence is found in the transitional metalwork. This seems to be limited to works solely in cast iron, which began replacing wrought iron in France as early as 1810. The Second Empire (1852-1870), however, saw the revival of the Louis XIV, XV and XVI styles of the seventeenth and eighteenth centuries.[44] This is the period in which the French blacksmith, Lehec was producing his Louis XVI inspired work in St. Louis Cemetery No.1.

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[43] See later discussion on composition in section on Materials Identification, Provenance and Availability

[44] Richard Wattenmaker, *Samuel Yellin In Context*, Flint, MI: Flint Institute of the Arts, 1985, p. 9

Chapter 3. MATERIALS IDENTIFICATION, PROVENANCE AND AVAILABILITY

The extensive use of zinc is an essential characteristic of transitional composite metalwork found in St. Louis Cemetery No.1. It is employed in combination with what is assumed to be wrought iron and to a much lesser degree, lead and cast iron ornament. A more precise identification of the metals could provide a better understanding of their use and help establish their source.

Zinc was first produced industrially in Europe around 1812 when it was cold rolled and used for roofing.[45] By 1820, zinc sheet for roofing was being exported to the U.S.[46] The records of foreign shipments found in the Customs House manifest for New Orleans from the years 1806 to 1832 show wrought and cast iron coming mostly from Liverpool, England, but also wrought iron from Gottenburg, [Göteborg], Sweden, Quebec, New York and Boston. There are only two mentions of shipments of small quantities of sheet lead and no mention of zinc shipped into New Orleans during that time. There is recorded one exceptional shipment of 1,012 iron molds from Liverpool in 1830, but these could have been for the casting of anything from domestic items to parts for sugar milling equipment.[47]

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45 Maison de la Métallurgie, La, Liège, Belgium, web site : www.netline.be/atlas/liege/musee/met/home_met.htm

46 Carol A.Grissom, 2002. Zinc Time Line. A handout for a lecture on zinc sculpture given at the University of Pennsylvania for the Department of Historic Preservation, Metals Seminar

47 Customs Manifests – Federal Archives, N.O.L.A. Iron work. The entry indicates a certain Puech Beia & Co. as consignee. From: Ann Masson, Personal research files on New Orleans Ironwork, 2000. Additional customs records may be available from: *inquire@nara.gov*, The National Archives 36.3.1 New Orleans Custom Records 1803-1919, per Ann Masson, personal correspondence, June 2001

Priestley & Bein, a wholesaler in items for the metal industry in New Orleans ran an advertisement in the 1830s in the *Louisiana Courier* for various raw materials including bar iron; flat, round and square, from England and Sweden and the same from Tennessee and Pennsylvania along with sheet, bar and pig lead. They also, however, offered "Block-Tin, **Spelter, Zinc**, &c.", but with no provenance. Zinc was being applied to galvanizing since they list galvanized sliding door furniture in their advertisement as well.[48] Spelter is zinc in the form of ingots, the most common impurities being small percentages of lead, iron and cadmium.

Zinc is presumably mentioned separately from **spelter** because they meant **zinc** in another form, such as rolled zinc. An advertisement in the April 10, 1860 Daily Picayune for the Haller & Brother sheet metal works offers copper, galvanized iron, tin and zinc valley gutters and roofing.[49]

Before c1860, the zinc raw material had to have come from Europe since it wasn't until then that commercial zinc production was successful in the U.S.[50] The quality of the ore determined the means of extraction. In Belgium high-grade ore was available and the so-called Belgian furnace was developed for the successful extraction of zinc. The same process was not successful with the processing of many ores mined in the U.S. because of their high iron-manganese content. Success was finally achieved with Wisconsin ores in 1860. It wasn't until the later part of the

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[48] Mary Louise Christovich, Edit. *New Orleans Architecture, Vol. III: The Cemeteries*, Gretna, LA: Pelican Publishing Co., 1997, p. 141

[49] Ann Masson, Personal research files on New Orleans Ironwork, 2001. Since the zinc decorative elements in the cemetery were previously mistaken for lead, it may be worth reviewing the historic record for references to zinc.

[50] Carus, H.D. Historical Background. In *Zinc: The Science and Technology of the Metal, Its Alloys and Compounds*, C.H. Mathewson, ed. , New York: Reinhold Publishing Corp., 1959, p. 1-8

nineteenth century that a more scientific approach was taken to the extraction of zinc and that real improvements were made in production and in achieving higher degrees of purity.

The various distillation processes for extracting zinc from the ore will reduce the amount of other undesirable metals. Lead, cadmium and iron may still be carried with zinc vapors during distillation, appearing in the ingot and to a lesser extent copper, tin and arsenic. Refining can be done by liquidation removing lead and iron to a limited degree from a molten crude zinc. It can also be done by re-distillation to upgrade a spelter to high purity by exploiting the differential boiling points between zinc and the impurities.[51] There are indications that differences in the composition of zinc existed for sculpture, an example given is the addition of 3-5% tin advocated in nineteenth century German literature.[52] It is not known at this point if this carried over to the type of application of zinc found in the cemetery.[53] Based on a small sample of zinc sculptures, it seems that the purity of zinc was reaching over 99% by the 1880s.[54]

The Belgians and Germans led research in zinc metallurgy during the nineteenth century.[55] At the turn of the nineteenth century enough metallurgical studies of zinc had been carried out to determine the effects of various components of

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[51] Carus, p. 1-8

[52] Carol Grissom, "The Conservation of Outdoor Zinc Sculpture." In *Ancient and Historic Metals: Conservation and Scientific Research* (The Getty Conservation Institute, 1991), p. 286

[53] An analysis of a sample of the zinc used in the cemetery was conducted to determine what impurities are present, but is only of limited utility, (see Addendum D - Analysis of Metals). The subject for a book could be the study of impurities found in manufactured zinc objects over time, in different locations in Europe and the U.S. Such data would be of help in dating and determining the origin of the zinc in the cemetery assuming a good sampling could be obtained and precise composition could be determined.

[54] Grissom, p.286-289

[55] Walter Renton Ingalls, *The Metallurgy of Zinc and Cadmium*, New York: McGraw Hill, 1906, p. v

zinc based metals. The most common impurities found in commercial zinc at the time were lead, iron and cadmium with small quantities of arsenic, antimony, carbon and sulphur also being detected. Copper, tin and silver were found in some spelters. Most spelter had as much as 2-3% by weight of lead, which could be reduced by half with refining. The lead increases ductility and malleability of zinc to the point of making it soft. Iron in quantities of 0.20% w/w or higher is particularly harmful as it increases its brittleness. The common percentage by weight of iron in commercial zinc is between 0.01 and 0.05. Copper and tin will also make zinc harder and more brittle. Zinc and copper mix well in a range of proportions to produce various useful alloys.[56]

The Musson tomb enclosure, (THNOC #193), has a mixture of zinc elements not seen anywhere else in the cemetery, but also includes a commonly seen zinc rosette, (R-7) in the scrollwork on its distinctive cross. Microchemical analysis of its unique zinc frieze element showed a lesser reaction for tin content than all the other samples taken in the cemetery and is the only zinc ornament with a blue-green cast. Further elemental analysis of the zinc frieze might reveal the presence of copper that could explain the unusual color of surface corrosion. This could also be evidence for an originally applied coating. Following the invention of electroplating in 1838 in Europe, copper plating was the usual finish applied on zinc sculpture and was a means of producing inexpensive imitations of bronze.[57] In America, bronzing referred to the application of bronze flake paint, with electroplating not finding use on zinc sculpture

[56] Ingalls, p. 3
[57] Grissom, pp. 380-382. The implementation of this new technology was gradual.

until the twentieth century.[58] The tomb has a date of origin of 1819, which, given these clues, seems too early for the metal enclosure.

Pure zinc will recrystallize at or below room temperature. Alloying with copper or cadmium will only raise the recrystallization temperature a little. Heat treating after work hardening is therefore not an effective method for controlling the hardness of zinc.[59] Metallographic evidence of original strain or work hardening may not survive because of the ease of recrystallization reducing the reliability of microstructural study to determine the original method of forming or heat treating.

There are differing grades of wrought iron described according to their working properties in various nineteenth century treatises on metalworking. Some grades are better than others in responding to the essential processes of forge work, namely forging, welding, splitting and hot and cold cutting and punching.[60] The U.S. customs records only provide provenance, but this, according to period assessments, is not a sure indication of the properties of a bar stock. Each supplier was capable of producing a range of qualities of iron bar.[61]

The Englishman Henry Clifton Sorbie was the first to do a serious study of metal under the microscope starting in the early 1860s. It was not until the late nineteenth century that metallography became recognized as a useful means for

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[58] Grissom, p. 383

[59] G. H. Turner, Super-Purity Zinc. In *Zinc: The Science and Technology of the Metal, Its Alloys and Compounds*, ed. C.H. Mathewson, New York: Reinhold Publishing Corp. 1959, 390-400

[60] M. Paulin Désormeaux, M. H. Landrin, *Nouveau Manuel Complet du Serrurier : ou Traité Complet et Simplifié de Cet Art*, Paris : Chez Léonce Laget, Libraire-Editeur, 1866, Réimpression1977, vol. 2, 12-15

[61] Richardson, M. T., Edit. *Practical Blacksmithing*, New York: Weathervane Books, Four volumes in one, originally published in separate volumes in 1889, 1890 and 1891, Reprinted 1978, vol. 2, pp. 13-21

evaluating iron and steel composition and structure, becoming from then on a standard technique of metallurgical analysis.[62] The qualities of iron and steel until then had been determined solely on the basis of empirical testing. The lack of means of scientific analysis provided only very rough, subjective and unreliable measures of quality.

Available customs manifests dating between 1806 and 1832 indicate that most bar iron came from Liverpool, followed in quantity by Swedish "hammered iron" (wrought iron). The Swedes had been producing bar iron for export since the seventeenth century using blast furnaces.[63] The stone built "Walloon" charcoal fired furnaces continued to produce the quality wrought iron for which the Swedes were so famous, but the German process used in the production of forged bar iron accounted for approximately 90% of Swedish iron production until the 1840s.[64] From 1800 to 1860, Swedish bar iron production underwent a major shift to fewer and larger integrated ironworks with the use of the more efficient so-called "Lancashire" method of manufacturing iron, which originated in England. This was presumably the same method used to produce the iron exported from Liverpool in this same time period. In 1858, the Bessemer converter, another English process of manufacturing steel, was

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[62] Hammond, C., The contribution of Henry Clifton Sorby to the study of reflected light microscopy of iron and steel. In *The Journal of the Historical Metallurgy Society*, Vol. 23, No. 1, 1989, pp. 1-8
[63] Nils Björkenstam, The Swedish Iron Industry and Its Industrial Heritage, In *Ironworks and Iron Monuments, Study, Conservation and Adaptive Use*, Symposium, Ironbridge, England, 23-25 .X. 1984, Rome: ICCROM, 1985, p. 40
[64] Marie Nisser, Documentation and Preservation of Swedish Historic Ironworks, In *Ironworks and Iron Monuments, Study, Conservation and Adaptive Use*, Symposium, Ironbridge, England, 23-25 .X. 1984, Rome: ICCROM, 1985, p. 68

exported to Sweden where it eventually replaced blast furnaces, though the old Walloon charcoal fired furnaces survived with limited production up to 1966.[65]

Shipments of iron from U.S. suppliers would presumably not have been recorded by customs since Louisiana would normally have benefited from free interstate commerce as of 1812 when was admitted to the Union.[66]

If there were any reason to pursue it, an involved line of research might determine the provenance of the wrought iron used in the metalwork in the cemetery. The slag content and trace elements might give an indication of the ore and method of smelting and refining.[67] This could be cross-referenced with known characteristics of wrought iron from the various suppliers in Europe and the U.S. Chances are that the wrought iron used for the cemetery work, especially since it was small piece-meal work, was whatever was available with roughly the characteristics needed. Since certain properties like weldability at the forge were not critical to the transitional work, this may have increased the sources of supply. Since little of the work was forged, but rather hot-formed, hand-cut and filed and fitted cold, more homogeneous material may have been preferred. This was to become more available after 1858 with the advent of the Bessemer process and the greater control over composition that it provided with the production of steel. Older methods relied mostly on the skill of the bloomery foreman or finer of pig iron produced from the blast furnaces.

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[65] Björkenstam, p. 43 and Nisser, p. 76

[66] This requires confirmation. Since the iron industry was so important in New Orleans, industry records, if they survive, may be revealing of what iron was available commercially in New Orleans at the time, either produced locally or imported.

[67] A. R. Williams, Slag Inclusions in Armour, In *The Journal of Historical Metallurgy Society*, Vol. 24, No. 2, 1991, pp. 69-80

With the introduction of the Bessemer process in 1858, steel production took off in England. In the U.S., however, it wasn't until 1876 that production was finally made viable and the age of cheap steel became a reality. Between the years of 1870 through 1907, Bessemer steel made up 50% of all U.S. steel production, almost all of which was channeled into the production of rail for the expanding railroads.[68]

Because of the often fibrous look of the bar stock and the remarkable weathering the bar has shown, it has been assumed that it is all wrought iron. After 1858, steels of varying carbon content might have been available. Until at least the 1870s in the U.S., steel was too expensive to be used indiscriminately, the higher carbon content steel especially being reserved for tool making. Metallographic and elemental analysis could help clarify this if a large enough sample could be collected.[69] The results could also possibly be used as a means for rough dating. As Henry Sorbie was to demonstrate as early as 1863 with a series of cross sections, forged Bessemer steel had a much finer and more uniform grain structure than forged bars of wrought iron or cementation steel, which frequently displayed an enormous variation in slag or carbon content.[70]

An extremely costly method of steel production introduced in the 1850s was called the Huntsman crucible process. It produced better quality steel with a more uniform distribution of carbon.[71] However: "wrought iron remained the chief structural product until well into the nineteenth century, steel produced by the

[68] David W. Lewis, *Iron and Steel in America*, Meriden, CT: The Meriden Gravure Co., 1976, p. 38
[69] Limited metallographic analysis of the ferrous metals used in the transitional metal work in the cemetery has so far not revealed any use of steel. See Appendix D – Analysis of Metals
[70] C. Hammond, The contribution of Henry Clifton Sorby to the study of reflected light microscopy of iron and steel. In *The Journal of the Historical Metallurgy Society*, Vol. 23, No. 1, 1989, pp. 3, 5, 6
[71] Lewis, p. 35

Huntsman process being still a luxury product produced in small quantities, its price being about £50 per ton as against £3 to £4 for pig iron and £8 to £9 for wrought iron. In 1850 production in England of pig iron was about 3 million tons and steel only 40,000".[72]

The use of new materials and production methods are known to exercise a direct effect on design. There is no evidence in the cemetery to suggest that steel was employed in the fabrication of the transitional metal enclosures, where if it had been used, its material qualities might have influenced new design. It seems that the traditional wrought iron continued to be used, but was applied to designs with a novel more machine aesthetic. The greatest qualities of wrought iron, (weldability, malleability), were no longer being exploited The new expression had more to do with the employment of new means of production, including casting, (in iron and zinc) and an aesthetic born of the industrial revolution.

While cast iron had been in use in England from the mid eighteenth century, with its heyday between 1820 and 1860, cast-iron railing only started to take hold in America by the 1840s and made its first appearance as a major architectural element in New Orleans by 1849. Much of it was shipped from New York, Philadelphia and Baltimore[73]. It didn't take long for it to replace the use of wrought iron because production was so much quicker and cheaper. It was also able to easily satisfy the Victorian taste for excessive ornamentation. Cast iron is what caused the demise of the transitional composite metalwork.

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[72] Dennis, p. 6
[73] Masson, *Cast Iron in the Crescent City*, p. 2

The use of lead with the transitional metalwork was limited to post flanges and for anchoring of the posts because of its very low melting point permitting casting in the field. These small quantities required were certainly easily available since lead was also employed in plumbing and flashing for roofing.

Because of the extreme deteriorated condition of the paint, there is little chance of finding useful paint samples. It may not be possible to determine through paint analysis with any certainty the first finish or the full sequence of paint coatings. At present, it can only be said that much of the metalwork was painted black, and to a lesser degree white, at some point in its life and more recently in a few instances, metallic silver. Some evidence of what is assumed to be a red lead primer is also evident.

An elemental analysis of paint samples might provide information on the ingredients used in the paint applied, which could lead to determining color used at some point in the life of the metalwork. For example, lampblack or carbon and graphite were used most commonly during the nineteenth century in different formulations of black paints. Bronzing, a favored treatment for metal in the nineteenth century and one documented in use in New Orleans[74] in the 1850s required painting in a deep bronze green made by mixing chrome yellow with lampblack combined with varnish and turpentine. Before the paint was dry it was then rubbed with bronze powder. Bronze powder was also mixed with japan gold size dryer to make "gold"

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[74] New Orleans Notarial Records, J. Curvillier – notary, Dec. 5, 1851, vol. 56, no. 20, Contract for Jackson Square Fence, from Ann Masson's research file.

paint.[75] The nineteenth century in New Orleans displayed a hierarchy of finish paint color applications with black found on most utilitarian architectural metal, and bright blue-green, reddish brown or bronzing along with black reserved for more ornamental work such as balconies and galleries.[76] Unfortunately, no direct documented reference to paint color used on the metalwork in the cemeteries has yet surfaced.

Waxing and oiling was used along with black-lead or graphite to maintain metalwork during the nineteenth century, but required high maintenance and may have been reserved for interior work, or work easily accessible from inside such as a balcony. Brass detail, such as finials, used as accents on metalwork was certainly polished and possibly waxed or oiled along with the ironwork on railings, thereby preserving some of the contrasting texture and color of the metals. Metalwork treated this way, especially in an exterior application, would have required regular cleaning and frequent reapplications of wax or oil. This might not have been a practical option for metalwork in the remote location of the cemetery, which needed more attention than just once a year along with the whitewashing of the tombs during the All Saint's Day celebration.[77]

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[75] Franklin B. Gardner, *Everybody's paint book:* a complete guide to the art of outdoor and indoor painting…consisting of practical lessons in plain painting, varnishing, polishing, staining, paper hanging, kalsomining, etc…Precise directions are given for mixing paints for all purposes, New York: M. T. Richardson, 1888, p. 83

[76] Frank G. Matero with Joel C. Snodgrass, "Understanding Regional Painting Traditions: The New Orleans Exterior Finishes Study", *APT Bulletin* 24 (1-2, 1992): 45-47, The results of the study corroborated many early 19thC European writings promoting the use of green, blue green and brown for cast iron verandas in imitation of a weathered bronze patina. Red lead or iron oxides were found to be used as primers.

[77] Documentary evidence is needed to confirm this. While there are many references to frequent whitewashing of tombs, no specific regularly applied treatments for the metalwork in the cemetery have been revealed to date.

The low esteem in which zinc was held, (being generally considered an inexpensive substitute material),[78] the unattractive dull blue-grey oxide it formed in poor contrast with the wrought iron and the lack of finish and defects in the castings all suggest that the zinc was painted along with the ironwork from the beginning (plate 22). The primary advantage that zinc brought to the design of the work was the cheap and easy detail, which enriched the normally linear character of the metalwork with imitation carved forms in relief. Without the availability of zinc, there might only have been restricted use of more expensive cast iron detail. The general period treatment for zinc in other exterior applications involved coatings. Coatings will not only individually protect all the different metals found in the transitional composite work, but also prevent the conditions leading to galvanic corrosion.

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[78] This was certainly the attitude toward zinc with respect to its use in sculpture during most of the nineteenth century as documented by C. Grissom. Even when used uncoated toward the end of the nineteenth century, zinc sculpture was sandblasted to mimic a texture of stone. The fact that very few references have been found to zinc used as applied ornament in architectural metal detail, (as with lead), strongly suggests to the writer that it was not valued for its own aesthetic and only used in imitation.

Chapter 4. DESIGNERS AND MANUFACTURERS

Direct documentary information on the designers and manufacturers of the transitional metalwork in the cemetery has been elusive. With one exception in each case, all information has had to be compiled through indirect sources and is not yet conclusive. This information would personalize the work and contribute significantly to a better understanding of the design influences in the metalwork.

Jacque Nicolas Bussiere de Pouilly was a French architect that immigrated to New Orleans in 1833 bringing with him the latest in French fashion for tomb design.[79] His work is notable for its sophisticated design concepts. His influence on tomb design during his 36-year career in New Orleans was considerable. His designs, in at least two of documented cases, applied the previously designated "Empire- Crossed Bar" style enclosure with decorative zinc hubs. The Soulé tomb in St. Louis Cemetery No.2 documented by a J. N. de Pouilly sketch, has just such a design, as does the Dusuau family's 1846 tomb also in St. Louis No. 2. The McCall-Jones tomb (THNOC #286) built in 1857 in St. Louis Cemetery No.1 is attributed to de Pouilly and is closely modeled on a tomb in the Père Lachaise Cemetery represented in a pattern book that he had brought from France.[80] Very similar to the Soulé tomb in St. Louis No.2, is the marble Saulet tomb (THNOC #46) with an almost identical metal enclosure of the

[79] Ann M. Masson, De Pouilly Brings Parisian Avant-Garde Architecture to New Orleans, In *Preservation in Print*, 26 October, 1995, p. 26
[80] Christovich, p. 81 : Le Père Lachaise ou recueil de dessins aux traits et dans leurs juste proportions des principaux monuments de ce cimetière, Paris Quaglia. n.d.

Empire-Crossed Bar style with the zinc *coupelle moulée* or hub (plates 2, 29A, 30A). A reasonable assumption would be that this is another of de Pouilly's creations or at least a close copy of his work. It is unclear whether his influence on the transitional metal work extended much beyond this contribution.

New Orleans had a large community of metalworkers starting early in its history. This increased greatly in the nineteenth century when the city became a center for the manufacture of equipment for the processing of sugar cane and for steam boats plying the Mississippi River. By 1822, the city directories show 32 blacksmiths and five iron foundries in New Orleans.[81] Among these were a large and ever increasing number of Germans and Irish immigrants, with the Germans especially bringing a long tradition of metalwork, including cast iron founding. The 1860 census reveals that the greatest number of blacksmiths were from: Germany - (74), France - (67) and Ireland - (60).[82]

The one piece of transitional metalwork still carrying a signature in St. Louis Cemetery No.1 has a small brass plaque with the name "LEHEC" engraved on it, (THNOC # 573, Dubreuil, plate 4). It is of the more elaborate and finely manufactured enclosures in the cemetery. One other enclosure has some identical design elements and is of the same fine quality of manufacture, (Auguste, THNOC #238). Each has a high number of forged curvilinear forms and unique zinc terminations on scrolls, but they also carry zinc rosettes common throughout the cemetery.

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[81] Christovich, p. 140
[82] Ann M. Masson, Personal research files on New Orleans Ironwork, 2001

The Lehec name is the only name discovered so far with a direct association to the transitional metalwork. Only two examples of this work survive in St. Louis Cemetery No.1, but historic photos indicate there were others (plate 26A). Similar enclosures can be seen in St. Louis Cemetery No.2 (plate 30) and possibly exist elsewhere.[83]

Lehec could be the "Frenchification" of a common name in Brittany: Le Hec'h, (pronounced Le Herrr)[84]. It is a name also found in Normandy[85] and is a clear indication of French influence in the design of some of the ironwork in the cemetery.[86] The name Lehec shows up in the U.S. Census records for New Orleans only once in 1860. A William Lehec is recorded as a 30-year-old bachelor blacksmith living with an Irish family named Kating.[87] The census information means that Lehec resided in New Orleans for some undetermined period between 1850 and 1870. The City Directories for this period have almost yearly entries for a Joseph Lehec, a blacksmith and there is reason to believe that they could have been the same person.[88]

If he was signing his work, it must mean that at some point he was working for himself. Mygatt's Business Directory of 1858 does list a Lehec & Co., Blacksmiths located on Ursuline between Burgundy and Rampart on the edge of the French

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[83] These works were inspected for additional name plates and none were found.

[84] Ker ic Lannengwen, genealogist and native of Normandy, personal correspondence, 3.18.2002

[85] Pierre Lehec, personal correspondence, 4.9.02, grandson of the founder of the Lycée Claude Lehec, a technical college in agricultural machinery in Normandy, France

[86] Ann Masson has suggested that the records relating to passenger arrivals, New Orleans, 1820-1902 (M269) and the Quarterly abstracts for New Orleans (M272) from the USA National Archives and Records Administration available on microfilm may be worth consulting for additional information on Lehec's arrival in New Orleans.

[87] U. S. Federal Census of 1860 for New Orleans, Louisiana for free inhabitants in the 2nd Ward, 1st District, Orleans Parish.June 25, 1860, Samuel W. Slater, Assistant Marshal. The census lists Margaret Kating, age 36, possible widow, born in Ireland and her six children ages 6 to 20 years. Lehec, age 30, may have been a paying boarder along with the Katings.

[88] See Appendix C for the research data collected to date for the period of 1851-1866.

Quarter.[89] Lehec came to New Orleans in the period of the Second Empire during which there was a strong revival in the metalworking in France of the styles of the seventeenth and eighteenth centuries. This was precisely the mode in which Lehec was creating his work and may represent the latest expression of transitional ironwork in the cemetery. It is also the most technically advanced metalwork in the cemetery incorporating the greatest amount and most detailed cast iron and zinc elements.

The census of 1860 indicates that there were free men of color employed as ironworkers. Marcus Christian, in his book *Negro Ironworkers of Louisiana, 1718-1900*, documents the extensive participation of slaves and free men of color in the iron working industry in New Orleans. He makes the case that before the coming of the Anglo-Americans, slaves and free men of color dominated the building trades, including the ironworking industry in New Orleans. He cites a court case in 1842 in which the value of a slave blacksmith was as much as three times that of common laborers.[90] While the late eighteenth and early nineteenth centuries had been relatively good times for blacks in New Orleans, their situation started to change after Louisiana acquired statehood in 1812. Beginning in the 1820s, the ever increasing influx of immigrants from Europe steadily forced their black counterparts out of the metalworking trades. While owners with skilled slave workers fought to defend the status quo with the creation of the New Orleans Mechanics Society, white newcomers

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[89] A. Mygatt & Co., *Mygatt's Business Directory,* for New Orleans, 1858, on Microfiche at the Williams Research Center, New Orleans, LA. This is the only entry found specifically referring to the existence of an independent business under the name Lehec.
[90] Marcus Christian, *Negro Ironworkers of Louisiana, 1718-1900*, Gretna, LA: Pelican Publishing Company, 1972, p. 18

started to organize and questioned the "propriety" of employing slaves.[91] The market along with the demographics was changing:

> From 1830 until the Civil War the 'sugar barons' and the 'cotton kings' reigned in southern Louisiana. During that time, however, small blacksmith shops of New Orleans were not able to build or repair the huge sophisticated machinery that sugar mills required. As a result they gradually lost ground to large-scale foundries that were increasingly hiring their workers – founders, moulders, iron finishers, pattern makers, and blacksmiths – from the horde of immigrants who poured into the territory from the northern United States, Ireland, Germany, Scotland, England and France...By the 1840-1850 decade New Orleans had changed from a small 'Negro City' to a large 'white city', fifth in size in the Nation.[92]

In addition to this influx, many of the free men of color left the state in the years before the Civil War and new white-owned businesses would not hire blacks to avoid controversy. Whereas before the 1830s, the metalwork in the cemetery would have been largely attributable to either skilled slaves or free men of color, this would be less true later. Additional research is required to clarify the question of the involvement of black metalworkers in the conception and fabrication of transitional composite ironwork.

An 1858 advertisement in the Crescent City Business Directory for the James Nuttall "manufacturer...of iron railings for Tombs, Offices and Dwelling made to Order"[93] displays an engraving of a railing with spears and a gate showing a back to back "S" scroll motif and a center urn (plate 31). The gate panel design is almost

[91] Christian, p. 29
[92] Christian, p. 30
[93] Christovich, p. 144, holding of the New Orleans Public Library

identical to the two on the Brown/Fernandez/LaBranche tomb, THNOC # 568 in St. Louis 1 with a first date of 1843 (plate 1).[94] The advertisement shows what appear to be zinc spear points on pickets threaded through the top rail and fastened to the bottom rail. This is the same design as the railing around the double tomb #568. The scroll ends in the illustration terminate in a suggestion of the zinc rosettes found on the tomb gates. This advertisement documents a design for railings in existence by 1858, one that at least in the details of the pickets and scroll terminals, is widely seen throughout the cemetery reproduced in wrought iron and zinc. It is a safe assumption that this work being offered for sale as late as 1858 was transitional composite ironwork with zinc and not cast iron decorative elements.[95]

The shop owner's English name of Nuttall and the address of his shop at 174 Camp Street in the American sector suggest that he was either an English immigrant or a Northern transplant. Another metalworker, Daniel Edwards, trained in the foundry business emigrated from Liverpool and set up his own business in New Orleans in 1846.[96] The English precedent and influence in the cast iron industry is well documented.[97] Their contribution to the use of zinc in metal architectural detail has not been established.

Other metalworking establishments advertising production of iron railings or railings for cemeteries during the 1850s and 60s include:

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[94] So far documented., there is always the possibility that the metal work was added later.
[95] Cast iron ornament, of the kind found in St. Louis Cemetery No.1 in zinc, is present on enclosures in St. Louis Cemetery No.2, but in much smaller quantities than the zinc versions of the same designs, see plate 23.
[96] Christovich, p. 143
[97] See Section 6, Aesthetic and Technical Influences

Homes & Bennett, *Daily Picayune* Dec. 17, 1852 – Semi- Weekly Creole Nov. 21, 1855 – New Orleans Daily Crescent Sept. 2, 1856

Luther Homes, successor to Homes & Bennett, *Daily Picayune* Feb. 17, 18?? and April 10, 1860 – *New Orleans Daily Crescent* Oct. 15, 1861 -

Wood, Miltenberger & Co., *Daily Picayune* June 20, 1858 and Feb. 17, 1859 – New Orleans Daily Crescent July 22, 1858 – (known distributors of Wood & Perot cast iron products from Philadelphia, also with its own production)[98]

New Orleans Ornamental Ironworks, *New Orleans Daily Crescent* Oct. 15, 1861 – Daily Picayune April 10, 1860

William A. Beecher, apparently a distributor, advertised in the *Daily Crescent* of Oct. 2, 1849 "Steam Railing Works …iron railings made by machinery in Pennsylvania…tomb railings, etc…"[99]

Julian Murray, advertised in 1858 to furnish tomb grills[100]

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[98] Masson, *Cast Iron and the Crescent City*, p. 35
[99] Ann Masson, Personal research files on New Orleans Ironwork, 2001. Research repositories in Philadelphia may reveal what was this machine made railings were and if any made it into the cemetery.
[100] Christovich, p. 143

Chapter 5. TECHNOLOGY OF MANUFACTURE

Establishing how the metalwork was made is critical to determining how to conserve, repair and replicate it. This information will also contribute to an understanding of the context in which it was created and the effect of technology on design.

The transitional metalwork reflects the widest variety of metalworking expertise and is the most innovative and expressive in the cemetery. Forging involves forming with the benefit of increased plasticity of iron while hot. Cold working is forming iron cold. Hand cutting and filing or machining entails the removal of material. A clear example of forging in the transitional metalwork is seen in the corner reinforcement detail common to most gates (plate 17). The stiles were upset and formed with a thickened right angle to help prevent racking. An example of cold work is the forming of rivet heads. Removal of material either with hand tools (hack saw and file), or machine (drill press, milling machine), is seen in the cutting of dovetail joints (plate 20), and the threads on the wrought iron cores of zinc finials (plate 13).

There are a number of ways to get to the same results and many of these means were practiced contemporaneously, and as such are not always conclusive dating tools. Forged details can be made to look like machining even with minimal or no filing. Industrial blacksmiths were trained to forge within close tolerances. This distinction between techniques of fabrication is rendered difficult with many years of corrosion obliterating telltale markings and subtle differences in texture and with oxides potentially filling gaps in original less than perfectly fitting assemblages. Cleaning and

partial dismantling of metalwork in the cemetery could reveal which portions of the mortise and tenon assemblages were forged, if any, and which saw-cut or cold chiseled and filed or which may have been milled.

Many of the typical assemblages mimic wood joinery details, such as the use of dovetails (plates 15 & 20), mortise and tenons, dowels and splines. There are no obvious signs of hot working for the fabrication of mortise and tenon assemblages. There is no swelling of stock as with hot punching and drifting for the mortise. The tenons are not true tenons forged from the end of the rails, but are separate thin pieces inserted in a slot cut in the rail and riveted in place (plate 12).

Metallography might reveal any distortions in the configuration of the slag of the wrought iron due to hot work. For example, if a hole was hot punched and the resulting bulge forged back to original section with the use of a drift to maintain the opening, slag would show up contouring the hole in compacted drawn out layers rather than severed as they would be if the hole had been drilled.[101] The hot punching of holes while maintaining the original section is feasible, but difficult to accomplish within precise dimensional constraints because the stretching of stock with forging must be factored in.

The efficiency of one technique of manufacture over another depended not only on design criteria, but also on the metal smith's mastery of any given technique and on the tools that were available. For example, machine cutting a series of holes in top and bottom bars to accept pickets would be arguably simpler and more cost

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[101] See Addendum D – Analysis of Metals for metallographic images illustrating the distortion of slag stringers due to cold or hot working.

effective for a metalsmith, assuming the swelling of material was not desirable, maintaining original strength of the bar was not required and that an efficient drilling machine was available to him. Otherwise, hot punching would have been the better, if not only, option, but one available only to a skilled blacksmith.

Logically, the holes in the top and bottom rails of the metalwork in the cemetery would have been drilled. Various types of wall mounted or bench mounted *machine à forer* or hand powered drilling machines (also referred to as "*bascule*") are described and illustrated in a trade manuals published in France as early as 1841.[102] A later 1866 French manual describes in great detail the options available to metal smiths at the time for boring holes.[103] Enough information is communicated in both cases for the craftsman to fashion his own tool, thereby greatly increasing accuracy and productivity. The machines used drill bits of a design that were easily forgeable. These newer drilling machines permitted a continuous rotation in the same direction unlike the old bow-driven hand drills. The older drills required a double bevel cutting edge that scraped more than cut the metal first in one rotation, then the other, with the back and forth motion of the bow. A much more efficient cutting occurred with the flat single bevel bit.[104] Other parts for manufacturing the drilling machines could have been cast and machined in shops that were already well established in New Orleans

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[102] Louis Berthaux, *Le Parfait Serrurier*, Paris : Léonce Laget, 1841, Réimpression 1979, p. 2 and Planches 1 & 2. Note : This work also has designs for metalwork that may have been an influence on the work in the cemetery. See section on aesthetic and technical influences and accompanying illustrations.

[103] M. Paulin Désormeaux and M. H. Landrin, *Nouveau Manuel Complet du Serrurier : ou Traité Complet et Simplifié de Cet Art*, Paris : Chez Léonce Laget, Libraire-Editeur, 1866, Réimpression 1977, pp. 148-160 and Pl. 3, Pl. 15 – For a large capacity drilling machine with flywheel and provisions for automatically fed lubrification.

[104] Désormeaux, p. 154

producing machinery for sugar refining. By 1865, the Russell & Erwin hardware catalog includes among its blacksmiths' and machinists' tools "Striver's" Patent Combination Hand Drilling Machine:

> Its qualities consist, in its cheapness, simplicity, durability and the ease and facility of putting up, (taking very little room.) It is made entirely of iron, will work faster than any hand drill made; can be used either horizontal or upright, and with power if necessary.[105]

While the flat forged bits are shown with the drill, they are not offered for sale as it was probably assumed that the blacksmith would forge his own.

Wrought iron is softer than mild steel and is easily machined. The slag stringers throughout wrought iron cause a discontinuity of composition, which serve to break up cuts facilitating drilling. On the other hand, lower quality wrought iron is also more likely to have inclusions, voids as well as inconsistencies in composition, distribution of phases and hardness.

Judging solely by the work in the cemetery and what is known to have existed based on period manuals and catalogs, the shops producing the metalwork had the following tooling available to them:

. Coal forges

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[105] Russell & Erwin Manufacturing Company, *Illustrated Catalog of American Hardware*, original printing: New York: Francis Hart & Co. Printers, 1865, First facsimile edition, by the Association for Preservation Technology, 1980, p. 243

. Hand operated wall mounted drill presses, (an improvement over the simplest breast drill, which tended to produce oval holes)[106]

. Hacksaws

. Files

. Chisels of high enough quality steel for cold work, e.g. cape chisels for cutting mortises[107]

. Molds for casting zinc, lead and possibly iron decorative elements (plates 3A, 24-29)

. Taps and dies for tapping and threading to attach finials and as a means of assembly to fasten half lapped top rails at the corner posts (plate 13)

Cape chisels, (*bédâne* in French), are high carbon tools commonly used for cutting mortises or channels in iron:

> The *bédâne* is a chisel with one very long bevel. Because the instrument is very thick in the direction of the bevel, but very thin in the direction of the cutting edge: this tool, [is] uniquely designed to cut mortises [and] varies in thickness to infinity…[108]

The cape chisel was an indispensable tool in the early machine age before the advent of milling machines and for small work not warranting set up time on a machine. It

[106] Désormeaux, p. 151
[107] Francisco Azconegui Morán and Augustín Castellanos Miguelèz, *La Ferronerie d'Art: Guide Pratique*, Escuela Taller de Restauration "Centro Historico" de León, Paris: Editions Enrolles, 1999 (for the French edition), p. 62
[108] Désormeaux, p. 87-88, (Author's translation)

would have been a regularly employed tool in any of the metal shops in New Orleans and could have been easily forged by the shop blacksmith in the best tool steel. With a cape chisel, a skilled craftsman could cut a mortise with precision in a relatively short amount of time. This was most likely the method used for making mortises on the transitional metalwork in the cemetery. Because drill presses seem to have been used elsewhere, the cutting of the mortises could have been made with a combination of drilling and cold chiseling.

The milling machine was first invented by Eli Whitney in the first quarter of the nineteenth century to cut identical parts for the manufacturing of rifles for the U.S. government. It was initially essentially a mechanical replacement for the cold chisel, but developed many more capabilities. Whitney devised the machine to compensate for the lack of skilled craftsmen at the time in the U.S.[109] The machines required independent power and a precisely machined rotary multiple-toothed cutting tool for precision work. It is unclear when milling machines were available for use in shops in New Orleans. The work in the cemetery may be too corroded to reveal the subtle signs of machining.

It is interesting to note that Eli Whitney is also known for devising the manufacturing system of interchangeable parts. The fact that many of the same applied ornaments are found on a variety of different enclosures in the cemetery indicates that a form of independent part production was occurring. This was certainly true with a series of rosettes and finials, but could also have been practiced with the pre-

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[109] Mitchell Wilson, *American Science and Invention: A Pictorial History*, New York: Simon and Schuster, 1954, pp. 78-83

fabrication of other elements for similar railings, such as the most widely used element of fabrication: the round picket with the cast-on zinc picket point of the "Empire – Vernacular" type of enclosure (plate 3). While there are some differences in dimensions, there is enough consistency with this element to suggest, at least in theory, that these could have been made in quantity and even sold to other metalworkers as finished elements with the cast-on point and riveted end ready for installation on a separately fabricated wrought iron frame. The production of independent parts such as these is an industrial mode of production creeping in to fabrication of architectural metalwork and foreshadowing the entirely industrial production of architectural cast iron.

A round tenon method of assembly for attaching a picket end to a rail can be manufactured in at least five ways. There is no obvious way of knowing which method was commonly used in the cemetery, (see Appendix B for a description of methods). The most logical candidate for attaching the picket to a bottom bar given the constraints of the design and of their supposed period of fabrication was determined to be a French technique called a *rivet prisonnier* (prisoner rivet). In the case of the picket on the Marigny tomb (THNOC #606), a common design, the cast-on zinc picket point had to rest directly on the top rail. The casting on of the zinc point was not a very precise operation and depended on how much the wrought iron bar was drawn out with tapering to provide the zinc point with the necessary reinforcement. Judging by a period mold that was recovered and was very likely used for work in the

cemetery (plate 24),[110] the points had to be cast on first before the picket was installed and this because the location of the sprue for pouring the molten metal was through the shoulder end of the mold. The zinc had to be poured with the point upside down. The precise fitting of the picket had to occur at the bottom rail and the easiest means to accomplish this was by cutting the picket to exact length after casting on the point and installing a prisoner rivet (plate 11).

To confirm the method of assembly used for the pickets on the Marigny tomb enclosure, a sample was taken of the bottom end where the rivet had broken on one of the pickets and a metallographic assessment was carried out.[111] It confirmed first of all that the metal was wrought iron based on the slag inclusions that were stretched out along the longitudinal axis of the bar as they would be formed on a rolling mill. The corroded end retained a small protrusion, a remnant of the rivet that had corroded through (plate 11). There also appeared to be an indentation circling the rivet suggesting either pitting from corrosion or chasing of metal around the rivet. The sample was cut down the center in the longitudinal axis of the picket and revealed the presence of a trapped rivet head buried barely 3/16 of an inch into the picket end. The rivet is 3/16 inch in diameter, has only a very slight upset for the head and was formed cold with a small hammer. The profile of the cutting edge of the drill bit described earlier is seen in the bottom of the hole drilled for the rivet, (see enlarged section and drawing, plate 11). The probable reason for the failure of this particular rivet, while all the others have held well over a hundred and fifty years, is that the rivet had a

[110] This is one of a collection belonging to James Stoyanoff of New Orleans, see additional references below.
[111] See Addendum D – Analysis of Metals

particularly large slag inclusion, too large for its small section to retain structural integrity. In addition it may have been nicked by the cape chisel used to chase the metal around the head, which would have caused weakening and a point of entry for moisture.

The availability of specific technologies varies based on geographic region, which is determined by the size of the market. Cities in Europe tended to have the highest level of technical knowledge and means available. New Orleans was very isolated as a colony during most of the 18th C, but gained great importance as a port of importation of goods from Europe and other parts of the U.S. once it joined the Union in 1812. In addition, the importance of sugar cane cultivation provided the impetus for local means of fabrication of sugar cane processing machinery.

C. C. Whiteman & Co., the oldest foundry in New Orleans was established in 1823, becoming the Leeds Foundry soon after. By 1830, the *Louisiana Advertiser* reported a new Leeds Foundry facility in the Faubourg St. Mary as having "...eight lathes, from the largest to the smallest size, for turning and boring of every description in iron and brass, which are propelled by steam."[112] The fabrication of machinery required the highest level of technical knowledge in metal work, incorporating every possible means of manufacture from exceedingly precise and demanding industrial blacksmithing to machining and metal casting of all sorts.

We have seen that the industry attracted metalworkers from all of the most industrialized European countries. They brought with them the knowledge of the latest technologies. Before the Civil War, New Orleans was the largest city in the South and

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[112] Christovich, p. 142-143

the sixth in the nation, with a population of 168,000, doing an enormous trade with goods coming down the Mississippi and serving as a trans-shipment center for the export of these goods.[113] New Orleans was important enough as a port to insure that any needed tooling and raw materials were available with little delay, even though it was by no means an industrial center the likes of New York, Boston and Philadelphia.

In any case, the simplest and most cost effective methods would have been used for the fabrication of the cemetery metalwork. The level of sophistication for tooling is directly proportional to the demand for a given production. The time required to make a tool for mass production is considerable and not cost effective for limited, sporadic demand. In this case, the skill of the blacksmith is what determines the return on the job. Advanced mechanical equipment such as accurate lathes and drilling and milling machines, not normally available in a blacksmith's shop, may well have been present in an industrial shop. However, the lack of uniformity of design and dimensions found in the work in the cemetery would indicate that the work would have been done with hand tools. The work designated "Empire - Vernacular" with the repetitive round pickets with zinc spear points is by far the most prevalent type. The wrought iron frames for these even show significant differences in bar stock section and in the details of execution, providing further proof of the custom quality of the manufacture (plates 12-18).

An example of contemporary industrial production of architectural metal was the work produced by the New York Wire Railing Company in operation in the early 1850s and the precursor to the Composite Ironworks Company of New York. John

[113] Garvey, p. 139

Bartlet Wickersham, founder of the company, relying on the patent of a railing maker from Cincinnati, Henry Jenkins, developed a new approach to rail making which involved the casting of iron ornaments directly on intersections of interwoven wire. The *casting-on* at intersections was meant to supplant the need for riveted assemblies: "...The pickets which surmount this railing are also directly cast upon the rods. By means of this process, the rods are rendered completely immovable and firm, and the admission of moisture is totally prevented."[114]

The use of woven wire is not evident in St. Louis Cemetery No.1, but the approach to casting-on decorative elements is similar. Additional reasons for the casting-on were expediency and cost savings. Unprotected intersections of iron bars in an exterior application were certainly more vulnerable and without the cementing effect of the *cast-on* elements, would have required an excessive amount of skill and time to execute. Designs such as the Lehec railings with as many as eight bars meeting in a center could not have been carried out without welding or by casting on a hub (plates 21,22, 17A, 29A, 30A). While the New York Wire Railing Company work used cast iron, the work in the cemetery was cast in zinc. The industrial scale of the New York Wire Railing Company production permitted the relatively high temperature melting and casting of iron, while the piecemeal artisanal fabrications of the cemetery had to rely on the low melting point of zinc by melting in a forge for their decorative details.

[114] Wickersham, J. B., New York Wire Railing Catalog. In *Victorian Ironwork*, with an introduction by Margot Gayle, Philadelphia: Athenaeum Library of Nineteenth Century America, 1977, p. 4 of Intro. I am grateful to Carol Grissom with the Smithsonian Institute for acquainting me with this work.

In both cases this represented a new approach and the creation of so called "composite" metalwork. Cast iron decoration, separately cast and riveted on had been used for some time in architectural metalwork. What was new about this approach was that the elements were being cast directly on to the wrought iron armatures. That the brittleness of zinc was recognized is evidenced by the large number of decorative elements in the cemetery work that were reinforced with a wrought iron armature.

The cast zinc elements serving as "hubs" at the intersections of multiple bars such as the *coupelle moulée* on the Empire style cross bar motif, were not cast with equal success. The New York Wire Railing Company was casting their decorative iron elements at very high temperatures where the fusion of both ferrous metals was more likely. The casting of the zinc occurred at much lower temperatures and unless the mold and the iron could be pre-heated, the flow of the zinc required to fill all the interstices of an intersection could not be assured. Molten zinc will freeze in contact with cold surfaces, thus sealing the path to vents and creating air pockets damming the further flow of metal and preventing a perfect pour. In some cases as with the Saulet THNOC #46 railing, the large *coupelle moulée* were cast in two stages, with the back seemingly cast-on to the bars directly filling the crotch spaces between bars and then a separately cast rosette was fastened to the front with a rivet through the center (plate 21). This may have been to avoid the premature freezing during casting with a larger mass of zinc when the wrought iron could not easily be pre-heated. This detail, however, created a seam that allowed water to enter and collect at the intersection of the bars leading to rusting and oxide jacking causing the zinc hub to burst open. The

original molds for this detail have unfortunately not been found to help confirm this procedure.[115]

In St. Louis Cemetery No.1 zinc decorative elements were cast in the following manners:

- Separately and fastened with iron rivets or screwed to wrought iron frameworks, (rosettes and ball spacers were common (plates 12A-15A, 18A-22A);

- With iron armatures protruding as rivets for riveting in place on an iron framework, (seen with in-fill ornament (plates 25A, 26A, 38A);

- Onto a threaded rod and screwed into tapped holes often doubling as bolts, (such as finials at railing corners serving to hold down half lapped top rail at the corner posts (plates 8A-11A);

- Directly onto a wrought iron elements, (pickets points or *coupelle moulée* serving to hold crossed bars at their intersection (plates 21, 22, 1A-5A, 7A, 16A, 17A, 29A, 30A);

- As a combination of cast-on and riveting, (as with the aforementioned *coupelle moulée* detail (plate 21)

Either the exact molds or identical molds that served for the casting of a dozen zinc decorative elements used in the cemetery and elsewhere in New Orleans were recently found in an old shop in New Orleans.[116] Zinc castings were lately made from

[115] See plate 29 for an example of the type of mold that would have been used

[116] We have blacksmith Jim Jenkins and Robert Whitehurst, curator of the Gretna Green Blacksmith Shop to thank for recognizing the source of the molds and are grateful for the generosity of James Stoyanoff, New Orleans collector and owner of the molds in making the molds available for study and

these molds and a half a dozen were found to match the work in the cemetery. This means that the casting was occurring on locally produced metalwork for the cemetery. The molds themselves could have been:

- imported from Europe or other parts of the U.S., and/or
- been made locally either by using imported positives as patterns and/or
- the patterns were created by local pattern makers and the molds cast in iron or bronze in local foundries

The 1860 census of New Orleans reveals that there were a total of 24 pattern makers working in New Orleans – 8 - from Germany, 7 - from France, 6 - from Ireland and 3 - from Louisiana.[117] It is not known however whether any of them were capable of the type of artistic interpretation and sculpting required to reproduce decorative motifs.

There are a few unique designs of decorative zinc elements, specific to one tomb (Musson tomb (THNOC #193) (plate 38A) and the Perrault tomb (THNOC #351) (plates 24A, 25A), but most were used repetitively on many different tombs throughout the cemetery.[118] Approximately 33 different zinc details have been identified. Some of the zinc rosette designs were used as separately cast elements that were riveted on, but others were cast directly on intersecting bars. In the latter application, the molds were used in conjunction with another fitted mold carrying

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use. Mr. Stoyanoff found the molds in a wood box in a corner of a now defunct blacksmith's shop in the French Quarter known as Magendie's. The business was founded in 1921 and must have inherited the molds from a previous business. Most of the molds are either missing parts or are much worn and were likely "retired" to storage after extensive use. See plates 24-29

[117] Masson, personal research

[118] The Legion of Honor motif on the Perrault Tomb enclosure also appears in an old photograph of the Desban Tomb (THNOC #157) which was demolished.

another design. These molds were equipped with double hinges to fit around the intersecting bars.

Some zinc motifs are found cast in combination with other zinc ornament. It is as if different cast pieces were used as separate pattern elements in an additive mold making process to produce a composite casting. An example is the cast iron element used in the front side panels of the Auguste (THNOC #238) enclosure that has two leaf motif appendages on a rosette (plate 28A). The leaf motif addition is seen in use alone as a termination on converging scrolls in the Dubreuil (THNOC #573) enclosure of the same style, probably by the same metalsmith, Lehec (plate 14A).[119] This kind of tri-partite infill detail was popular in period Empire designs in France, but not in the pre-revolutionary designs[120] nor with the revival of these later in the nineteenth century.[121] The Empire style of design in metalwork was an unsophisticated collage of different decorative detail of which this is an example. Earlier classical designs were more flowing and had a greater integration of decoration and structural elements, de-emphasizing structure. Much of the ironwork in the cemetery has this same feel of disjointedness found in the Empire style, which reflects either a lack of understanding or respect for pre-revolutionary design theory.[122] It is clearly the product of a vernacular expression.

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[119] Another example of combined decorative elements is the composite rosette found as a center piece of the Perrault (THNOC #351) gate. The center of the rosette is the same design as the designated stand alone R-2 rosette found on a majority of the gate crest scroll terminations throughout the cemetery.

[120] Faure, Vol. 3, p. 3, 6-9, and Faure, Vol. 2

[121] Louis Perroux, La Serrurreric d'Art : Compositions sur les styles Renaissance…Louis XVI, Dourdan, France : Editions H. Vial, 1997.

[122] This kind of eclectic approach to design was employed with greater sophistication and taste much earlier in the eighteenth century by the Adam brothers, see the following section.

Chapter 6. AESTHETIC AND TECHNICAL INFLUENCES

A worthwhile, but demanding exercise is determining what design theories or other influences on creativity and what technical advances defined the character of the transitional composite metalwork found in the older cemeteries of New Orleans.

We know that New Orleans in the nineteenth century was an amalgam of cultures. In addition to the technical cross-fertilization that certainly existed with the different metalworking traditions represented, there presumably would have been a thorough mixing of design sensibilities from Germany, France and England primarily. The Spanish influence seems to have largely disappeared with their loss of the colony in an earlier time when the metalwork was exclusively forged. Forging was mostly retired as a metalworking technique with the coming of the industrial age. The transitional composite metalwork in St. Louis Cemetery No.1, along with every other aspect of life in New Orleans, is the manifestation of this technical and aesthetic miscegenation. A particular challenge is determining what specific design influences the Spanish, German, Irish and French immigrant brought to the mix. Raw materials came directly from England, but what influence did the English have on design of the transitional composite metalwork, if any? What influences were filtered through the northern states from abroad or originated in the North?

As a major port, New Orleans benefited from an extensive contact with America and Europe, as well as Cuba, Mexico and the Caribbean. As a major destination for immigration, its arts and manufacture were influenced by the direct transference of the latest styles. The extensive contributions by the French architect de

Pouilly to the design of tombs and the contributions of the French metalworker Lehec and others like him are examples. De Pouilly brought the book of designs of tombs from Père Lachaise by Quaglia from which he drew heavily for his work. Craftsmen brought personal experience, but also must have brought trade manuals and pattern books such as Louis Berthaux's *Le Parfait Serrurier.* Berthaux's designs may have provided some guidance for the basic layout of the front of the enclosures, (if not for the in-fill designs), found in the St. Louis Cemetery No.1 and some designs for crosses in St. Louis Cemetery No.2 (plate 9).[123] The *Planche 69* entitled "*Grille de Chapelle, No.1*" shows a gate with a *couronnement* (crowning or cresting) and small cross and two side panels meant to mark the entrance to a small chapel. The *Planches* 70 and 71 are suggestions for alternative designs for chapel grills (plate 10).

Planche 74 is the most telling of all the illustrations as it could have been the basic model for most of the transitional composite metalwork enclosures found in St. Louis Cemetery No.1 (plate 9). It illustrates the corner and gate posts with the use of molded bases and cast pine cone finials at the top of the corner posts used to hold down the top rail. A scroll type of cresting is drawn over the gate with a diminutive cross. A diagonal lattice motif in the panels, although not found in the cemetery, has rosettes at the intersections of the bars. The whole is anchored into what could be a marble slab such as those found in the cemetery. The Berthaux model shows the gate slightly wider than the side panels. The width of the gates in the cemetery was

[123] Louis Berthaux, Louis, *Le Parfait Serrurier*, Paris : Léonce Laget, 1841, Réimpression 1979, Plate 73 – *Croix No.* 1 design found in St. Louis Cemetery No.2, Plate 74 – shows the basic structural layout for most of the metalwork enclosures in the cemetery, Plate 77 shows a similar Roman cross bar design to what is found in St. Louis 1

predicated on the width of the caskets that must clear the ironwork for placement in the tomb vaults located directly behind. The width of the side panels of the front elevation of the enclosures in the cemetery are determined by the width of the tomb and tend to measure about three quarters the width of the gate. The constraint of the tomb width imposes a more vertical impression on the cemetery ironwork than Berthaux's representation, and the gates in the cemetery do tend to be taller in proportion to their width than Berthaux's gate. This additional height may also have been intended to impart an increased sense of security by further impeding access.

Berthaux's descriptive text emphasizes that his designs are only guidelines. While he suggests a range of dimensions for the height of railings he allows that different circumstances will dictate slightly different proportions and detail:

> These drawings can be applied to an infinite number of other uses despite their small height, this will depend on the location where the ornaments must be placed and in the case where the sites require larger dimensions, it is always easy to establish proper enough proportions to impart to the ornaments all the elegance to which they will be susceptible, according to the drawings.[124]

The applied ornaments are indicated as being either *en fonte* (cast) or *en cuivre* (in copper). There is no more precise information given, suggesting that the casting could be in any available appropriate material. Elsewhere he refers to materials being *en fer, en fonte, ou en cuivre coulé.*[125] Presumably the latter is brass or bronze, but

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[124] Berhaux, p. 30, Author's translation

[125] Berthaux, p. 33, The use of "fonte" in French is often qualified: "fonte de fer" – cast iron or "fonte d'acier" – cast steel. However, the term font is also used alone to refer to cast iron: "poêle en font". "Cuivre rouge" is usually used to indicate pure copper and "cuivre jaune" or "laiton" – brass.

there is no mention anywhere of zinc. The book was published in 1841 and this suggests that zinc was not used as applied ornament in architectural detail in France at that time. However, his lack of precision in specifying materials is in keeping with his general approach throughout the work of presenting his designs only as a point of departure for the professional. As Berthaux indicates in his introduction, the difference with his publication is that he is a professional metalsmith with design abilities able to provide design guidance based in practical experience. Throughout the book he shows great respect for the tradesman, writing as an equal, and may be thereby leaving out much of the basic technical information that we as researchers would want to read, but which he took to be superfluous given his chosen audience.

The pattern books available to designers in the early nineteenth century were the primary conveyors of the classical Roman and Greek aesthetic principles. An important quality that the classical idiom has to offer, according to Scruton, is the principal of shadow:

> Aesthetically speaking, buildings are not composed of brick and stone and stucco, but of light and shade. Or rather they emerge from the interaction between the materials from which they are built, and the light in which they stand.[126]

While there remains a large difference between carved and molded forms, Scruton argues that the "sculpting" of shadow using substitute materials such as pressed tin or

[126] Scruton, p. 24

cast metal is a far superior alternative to no ornament. Ornament is what provides the humanizing element in architecture, which was sacrificed with the modern movement.

The use of cast iron in architectural applications in England dates as far back as 1714 when a heavy "baluster style" railing was installed around Sir Christopher Wren's St. Paul's Cathedral in London. The use of cast iron gradually increased during the eighteenth century. In *The Complete Body of Architecture*, published in 1756, Isaac Ware makes the case for cast iron:

> ...that cast iron is serviceable to the builder and a vast expense is saved in many cases by using it; in rails and balusters it makes a rich and massy appearance when it has cost very little and when wrought iron, much less substantial, would cost a vast sum.[127]

It was often used as a substitute material initially for decorative elements that were difficult and/or too costly to produce in wrought iron.

One of the earliest and perhaps most talented designers in the eclectic use of metals in architectural work was Robert Adam. His great facility and free spirit allowed him to combine cast iron, wrought iron, brass and steel, making the best use of the qualities of each to suit his designs.[128] Adam's technical mastery of the different mediums in metal and his willingness to experiment would have made his work a natural source of inspiration for the transitional composite metalwork in the cemetery. In addition to the general approach he took of mixing material and techniques, his

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[127] As quoted in John Gloag and Derek Bridgwater, *A History of Cast Iron in Architecture*, London: George Allen and Unwin Ltd., 1948, p. 116
[128] Gloag, pp. 116-117

work includes similar motifs applied to work in the cemetery. A cast iron anthemion element, which would have been difficult to execute in wrought iron, especially in the rounded forms required by Adam, is found in a pair of circa 1770 gates from the garden entrance of Landsdowne House, London. Similar cast iron anthemia can be found in several of the more classically inspired gates in the cemetery (plates 8A, 36A). The Adam style was based on the classical Greek approach of ornament being applied to construction, not integral to structure.[129] In the Landsdowne gates, the structural frame is of wrought iron and the applied decoration is cast iron. Except for the cases of the structural cast-on zinc *coupelle* or rosettes acting as a hub, the ornament in the cemetery transitional work is also an adjunct to wrought iron structure. Relatively little was published of the Adam designs in iron. Starting in 1774, John Carter published plates in his *Builder's Magazine* that displayed the Adam style. The influence of the brothers Robert and James Adams with their elegant new interpretation of the Greek and Roman orders and particularly their fresh approach to the medium was more based on the many examples provided by their prolific production. A significant contribution of theirs was the use of units of design in many different applications, creating a design system of interchangeable parts.[130] This seems to have trickled down through the years and at the least indirectly impacted the design of transitional metalwork in the cemetery, aided by the ever increasing availability of industrially produced ornament:

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[129] Owen Jones, *The Grammar of Ornament*, reprint of 1910 edition, Paris: L'Aventurine, 2001, p. 46
[130] John Harris, *English Decorative Ironwork from Contemporary Source Books 1610 – 1836*, London: Alec Tiranti Ltd., 1960, p. 11

> Factory production went hand in hand with an eclectic repertory, and nowhere in the realm of iron work is the breaking down of traditional forms more apparent than in Lewis Nockalls Cottingham's *The Ornamental and Metal Worker's Director* which appeared in 1823, and in 1824 as *The Smith and Founder's Director*. His examples are drawn from existing buildings and from his own designs. Nearly all of them exhibit a weakening tendency brought about by the admixture of *foreign*[131] forms and by the re-arrangement of already established ones. It is precisely this re-arrangement that is the key-note to the *fin de siècle* malaise with eighteenth century forms and the awakening desire to explore as many unopened channels as possible.[132]

In the pattern books, two-dimensional line drawings of classical decorative elements were shaded to suggest volumes. These are for the most part gross representations that were interpreted in any medium with the choice of method of execution and level of craftsmanship left to the interpreter of the design. A pattern maker adapted the designs to a given application. Thus a certain classically inspired rosette would have its center flattened in anticipation of the relief that the riveting, required for fastening, would add back in a limited manner with the formation of a rivet head (plate 18A).[133]

The approximate reproduction in cast metal of ornament that was originally carved in stone could have its crisp lines and texture restored with the technique of chasing traditionally applied to the decoration of precious metals. Chasing was used to finish cast bronze detail and also often in conjunction with *repoussé* on architectural ironwork reaching its finest expression in eighteenth century French royal

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[131] Italics by author – Another indication of the cross-fertilization occurring increasingly across national boarders

[132] Harris, p. 12, See later discussion on Cottingham

[133] An example of this from the cemetery metalwork is the rosette designated R-5, the design for which was possibly taken either from Cottingham's or Thomas U. Walter's pattern book. See later discussion in this section.

commissions.[134] During the reign of Louis XVI, previous extravagant constructs in sheet metal were largely replaced with less fragile and better wearing cast decorative elements. These were made in bronze at first, then in chased malleable cast iron and finally cast iron, which was used unfinished.[135] Even before the revolution, the art of chasing in France suffered a great decline because of the lack of disposable income and the high cost of skilled craftsmanship.[136] Its use on architectural works was rare to begin with, and the application of rough castings became the norm after the Revolution in France. Cheaper ways to produce work in every area of the decorative arts were being explored, along with the use of less expensive substitute materials such as zinc in replacement of bronze.[137]

The cast zinc of the cemetery metalwork was used with little apparent finish. Certainly chasing was never employed, the zinc picked up enough detail from the mold and in some case sprues and vents were even left untrimmed. No extra skilled handwork was expended on what was a lesser quality material. It was certainly cheaper to cover the lack of finish along with other defects in the work and the undistinguished dull grey of the zinc in a thick forgiving coat of paint.

The zinc castings on the cemetery metalwork were conceived without pretension and only as an approximation of the pattern book designs, their classical origins possibly not even being considered. The work was not designed and executed for the "cognoscenti." According to Scrutton, this alone is enough reason to venerate

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[134] M. Guenot, *Histoire de la Ciselure*, Course Manual, Lycée Technique Boulle, p. 45
[135] Phillipe Faure, *La Ferronnerie d'Art Dans l'Architecture des Origines a Nos Jours : De Louis XIV à Louis XVI*, Tome 2, Paris : Editons Eyrolles, 1978, p. 61
[136] Guenot, p. 42-43
[137] Guenot, p. 47

it.[138] It should in any case be evaluated on its own terms without imbuing it with qualities it was never meant to have. For example, such subtleties as can be produced with the interplay of metals of different colors and textures as was developed for use in eighteenth century French metalwork for royalty was not part of the program.

Already mentioned is the question of the influence on design that tooling, material and expertise available within the New Orleans metalworking community must have had. These influences are best characterized by a great mixture of techniques represented in the metalwork. The ubiquitous cross and crest detail on the gates of the transitional metalwork for example, combine hot forming, cold worked assemblages and a minimum of forging or hot modeling of the wrought iron with hammer on anvil (plates 2,3,5,7). The scroll work is made of standard dimensional stock hot formed with no change in section giving the ironwork a linear flow, but no texture or change in section. Only the scroll ends are forged to provide the necessary mass for a drilled riveted connection to hold the zinc rosettes. Where the two scrolls meet to share a rosette, their ends are half lapped to permit the scrolls to lie in the same plane (plate 19). The lapping can be accomplished with a partial forming of the scroll and sawing or with a completely formed scroll, by drilling to remove material, cold chiseling and filing. Here a combination of techniques are used for effects also found in the most sophisticated forged, cold worked and hand-machined French works of the eighteenth and nineteenth centuries. This is a tradition of locksmithing work or

[138] Scruton, p. 25

serrurerie that combined very precise calibrated cold and forge work essential to lock-making.[139] It was also applied to elaborate furnishings and architectural detail.

The multiple sharp angles of flat bar on edge that make up the crosses could not have been efficiently forged because of their small section. These are dovetail assemblages, which were each made cold by cutting, cold chiseling and filing (plate 20). A very tight fit was insured and excess metal was allowed for cold forging to clamp the joint tight. The centers of the cross were half lapped and here again tightened either by cold chasing metal over the joints or simply clamped tight between two riveted zinc rosettes. Today these joints would most likely be welded and ground with a certain savings in labor, but usually do not produce angles as sharp and clean as in the original fitted work. Even though the joints were undoubtedly mostly done by hand, they project a precise machined aesthetic of the sort prized by the French *serrurier*.

While the joint work shows remarkable precision, the scroll work is less consistent, often lacking symmetry (plate 7). We might now find this incongruity charming, but in the nineteenth century, within the trades, this kind of imprecision was not normally well valued. A lower standard of work can perhaps be explained by the mixture of techniques and the possibility that the fabricator was not a blacksmith by trade and lacked the skill to form identical scrolls. These commissions may well also

[139] It may be of interest to note that in Kerr's Crescent City Directory for 1856, Lehec was listed as a locksmith and only later as a blacksmith since the work he was doing in the cemetery corresponded more to the Anglo-American notion of blacksmithing as opposed to the very specialized trade of locksmithing as it was viewed in the U.S.

have been accepted only as fill work in some shops and were done with a certain expediency at times to get them off the books when more lucrative work appeared.[140]

A preliminary analysis of dimensions of bar stock sections and overall dimensions of the crosses on gates shows great variety. This would suggest that the metalwork was done one enclosure at a time and was not produced even in a small series. Apparently time was not taken to create a scroll jig to insure uniformity. It is conceivable that other influences, such as the predominant industrial metalworking background of metalworkers attracted to New Orleans, was more relevant to the design and execution of the transitional metal work where forging at this small scale was not prevalent and cold, more machined work was. In other words, it may be that the metal smiths that came to New Orleans were not so much trained in traditional architectural work, but rather industrial methods and naturally applied the techniques of metalworking that they were familiar with, thereby unknowingly creating a new vernacular expression dictated more by available means, materials and expertise than rules of classical design.

Design influences from German immigrants are difficult to identify. The last clearly German expression in wrought iron in Germany was the German Rococo characterized by unrestrained extravagant ornament.[141] No contribution to design of this sort is evident in the transitional metalwork. The influence may be very subtle or

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[140] Christovich, p. 142, Early foundries in New Orleans had as their main production the casting of parts for large equipment, but also advertised "ironwork of any kind" (plate 21). As anyone would know who has run a shop with any number of employees, there are always lulls in the stream of orders and employees need to be kept busy. The "ironwork of any kind" could have included the unpredictable demand for custom metal work for the cemetery. Such busy work was kept in reserve when there was not enough volume of casting to be done to justify firing up the furnaces and could just as easily been expedited when the volume did reach a critical mass.

[141] Geerlings, p. 134

might have more to do with an indirect contribution in the form of technical insights, such as with casting technology, for which the Germans were particularly known.

In addition to the wrought iron structure and infill and the cast zinc decorative detail, lead was used to anchor the posts in the marble thresholds. It was also used as a material for decorative post bases. There is evidence for their having been poured in the field with hinged molds around the foot of each post after installation. The lead bases used to cover the forged split foot gate post anchors are particularly elaborate, mimicking the typical First Empire or Regency detail of a lions paw (plate 30, 32A).[142] The application of such an elaborate detail to such a very specific and limited use as the covering of a split foot post would indicate the general use of the split foot detail outside the cemeteries of New Orleans. It is hard to imagine how the creation of such an elaborate pattern and mold could have otherwise been justified.

A new appreciation for zinc came with its greater availability in the mid nineteenth century and because: "Zinc fills the moulds very sharply, and is, therefore, especially adapted to ornamental and art casting...Metallic moulds, if used, must be previously heated."[143] The surface of the mold was coated with soot as a parting agent before the pour.[144]

The incorporation of cast zinc elements in the designs and construction of the transitional composite metalwork is one of its major defining features. We have already speculated on the origins of the molds for the lead or zinc ornament. So far

[142] Ann Masson, interview on New Orleans Metalwork and Stylistic Influence, Feb. 18, 2002
[143] William Brannt, *The Metalworker's Handy-Book of Receipts and Processes*, Philadelphia: Henry Carey Baird & Co., 1896, pp. 223-224
[144] Wickersham, Intro p. 5

examples of the cast motifs from the St. Louis Cemeteries have not been found outside of New Orleans. This would suggest local manufacture, but needs to be confirmed.

The pattern book by the French decorative ironworker H. Grave published in 1881 of designs collected during 10 years of travel through France, Germany, England, Italy, Spain, Switzerland and Belgium was a remarkable resource for metalworkers. It notably advertises the sale of H. Grave's own invention of adjustable molds for pouring zinc, tin or an alloy of lead and antimony directly onto iron bars for decorative effect. There are molds for collars, post bases and terminals, but none of these cast designs match the St. Louis Cemetery No.1 work. One illustration of what is referred to as a "Marguerite, no. 1", but produced in stamped sheet metal, is identical in design and size to the smallest rosette widely found on the cemetery metalwork, (ref. code: R-1 in this study, Plate 13A).[145]

The distinctive Perrault tomb, THNOC #351, has a unique set of decorative elements in zinc with only a few of them repeated elsewhere in the cemetery. They clearly reflect First Empire or Napoleonic martial symbolism including cast zinc arrowheads and feathers (plate 37A), along with an abstracted representation of the *Légion d'Honneur* medal, the Napoleonic order of recognition for service to France (plate 25A). This is modified in symmetry to allow for attachment to the wrought iron frame. These first quarter of the nineteenth century motifs could well have been

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[145] Henri Grave, *Travaux en Fer Forgé,* Toulon : Grave 1881, avec *La Ferronnerie : Le Nouveau Serrurier*. Inventeur du moule universel…Contenant toutes les nouveautés de l'exposition 1878. Henri Veyrier Pub., reprint Slovakia : NEOGRAFIA s.a. Martin, 2001, « Ornements en Tôle Fine, Emboutie »

carried into the later parts of the nineteenth century in New Orleans given the local fascination for Napoleon in the French community.[146]

The ironwork by the French blacksmith Lehec carries a detail that was common starting in the eighteenth century in France. Ball spacers were used as a conscious design feature meant to avoid the visual sloppiness of tangential lines in a composition of ironwork.[147] The separation of curved and straight elements creates a crisper, airy and better articulated effect (plate 12A)

The large diameter zinc *coupelle moulée* (plates 29A, 30A), acting as a hub at the intersection of square wrought iron bars on many of the enclosures is a design concept often seen in pattern books, including the aforementioned H. Grave's 1881 compilation of designs[148], but also in the earlier *Modèles de Serrurerie Choisis* of 1826 by French Architect Bury [149] and Thomas U. Walter's *Guide to Workers in Metals and Stone* of 1846.[150] The Parisian cemetery Père Lachaise, opened in 1804, has numerous examples of the same design, but it seems that the hubs are of cast iron and not zinc.[151] Available French pattern books indicate only cast *iron* elements.

The motif of the crossed arrows, typical of the Empire style, is found in most of these pattern books. Some of these designs were liberally lifted from other sources.

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[146] It would interesting to know what Napoleonic connection Appolinaire Perrault might have had.
[147] Lecoq, p. 12
[148] Grave, p. 110
[149] Jean Baptiste Marie Bury, Modèles de Serrurerie : choisis parmi ce que Paris offre de plus remarquable sous le rapport de la forme, de la décoration et de la sûreté : accompagnés des détails qui doivent en faciliter l'exécution et suivis d'un abrégé de l'Art du serrurerier [par Hoyau], Paris : Bance aine, 1826, Pl. 8
[150] Thomas U. Walter and J. Jay Smith, A Guide to Workers in Metals and Stone: for the use of Architects and Designers, Black and White Smiths, Philadelphia: Carey and Hart, 1846, Plate LXXIX
[151] Interview with Carol Grissom, recently returned from a visit to Pére Lachaise. July 8,2001

Thomas U. Walter's *Guide*[152] has the exact same design for a balcony with crossed arrows as found in Bury's earlier *Modèles de Serrurerie,*[153] illustrating the great cross-fertilization going on between the industrialized countries with increased communications. Both the Perrault THNOC #351 and the Crescioni THNOC #1500 tombs carry the crossed arrows as their central motif with the points and feathers cast in zinc on a wrought iron shaft (plate 37A).

The previously mentioned publication that had a great influence across the English speaking world in the first half of the nineteenth century was published in 1823 by Lewis Nockalls Cottingham, architect and antiquary, and first entitled *The Ornamental Metal Worker's Director.* A second expanded edition was published in 1824 entitled *The Smith's and Founder's Director.* In the preface of the first edition Cottingham explains his reason for publishing:

> The great improvement that has taken place in our Brass and Iron Foundries within these last twenty years, has elevated this branch of English manufacture far above that of any country, and raised the articles which were formerly considered as merely gross and ponderous into the scale of ornamental embellishment, in which utility and security are united with the lightness and elegance of classical design. The fidelity and correctness with which the Smiths and Ornamental Metal-workers execute their orders, must make a work, which is calculated to improve their taste, and excite emulation in getting up their patterns, generally useful and beneficial; and the decided favour that has ever been shown by gentlemen of fortune and liberal minds, to the ingenious artisan and aspiring tradesman, who are capable of combining utility and elegance in the various articles for domestic purposes, has been sufficient stimulus to the Author to use every means in his power to introduce

[152] Walter, Plate LXXVIII
[153] Bury, Pl. 12

> such a collection of Designs and Patterns as may be a guide to them in forming correct and tasteful composition...[154]

Here was a very conscious effort to disseminate designs for the use by industry and artisans at the beginning of the nineteenth century. There is an obvious excitement with the immense possibilities for expression in cast metal. The technical advancements afforded great new opportunities for production in series and widespread dissemination of art work in a variety of applications, but this came with the responsibility for good design. The proven precedents from antiquity were to provide the foundation for new design and were not meant to be slavishly followed. James Savage, an architect and friend elaborated in 1836 on Cottingham's ideas regarding the issues of copyism and "fitness for purpose":

> We see the consequences of tamely copying and repeating forms, which copied, are destitute of that living principle which first prompted them...(The essential qualities, the)...harmony of the totality and the singleness of intention are thus lost.[155]

Many of the designs offered were drawn in considerable detail and show many of the same influences found in the designs of the cemetery ironwork. Crossed arrows were also a popular Regency motif. Examples of Greek and Roman ornament abound, including the anthemion, the common Greek ornament based on the honeysuckle or

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[154] As quoted in: E. Graeme Robertson, and Joan Robertson, *Cast Iron Decoration: A World Survey*, NY: Thames and Hudson, Inc., 1977, p. 19

[155] As quoted in: Janet Myles, *L. N. Cottingham 1787-1847: Architect of the Gothic Revival*, London: Lund Humphries Publishers, 1996, p. 19

palmette interpreted in various ways throughout the cemetery in cast and wrought iron (plates 8A, 36A). Designs for rosettes in Cottingham's *The Smith's and Founders Director* were directly inspired by classical precedent.[156] One rosette found in St. Louis Cemetery No.1 and referred to in this study as R-5 (plate 18A), is represented in Figure 291 in his book entitled "Rosettes and wreaths". Cottingham's inspiration may have been a stylized rose discovered on the Roman Temple of the Sibyl of Tivoli.[157] The same Figure 291 was copied wholesale twenty-one years later by Thomas U. Walter his 1846 *Guide to Workers in Metals and Stone* published in Philadelphia.[158]

The epitome of Roman martial symbolism is the spear head. Models for this were lifted from period Roman stone carvings such as those found on a third-century sarcophagus now in the Lateran Museum, where spear points are very clearly represented (plate 1A).[159] The spear points found on the Roman – Vernacular designated metalwork are in turn interpretations of the scholarly documentation, whereby the classical form is perhaps embellished slightly with a more elaborate base.

Robertson, in *Cast Iron Decoration* mentions line and wash drawings produced by Cottingham showing both interior and exterior ironwork painted in shades of yellow, green and brown.[160] The author affirms this indicates that ironwork

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[156] While Cottingham is most remembered for his close study of the Gothic and contribution to the Gothic Revival movement, the designs in his compilation of designs for metal work were drawn from a broad spectrum of historical precedent.
[157] Carlo Antonini, *A Small Collection of Ancient Rosettes: as found on the Roman monuments*, London: John Tiranti & Co., 1913
[158] Walter, Plate 5, Rosettes and Wreaths
[159] Phyllis Williams Lehman, *Roman Wall Painting from Boscoreal in the Metropolitain Museum of Art*, Vol. V of Monographs on Archeology and Fine Arts, Cambridge, MA: The Archeological Institute of America, 1953, p. 43
[160] Robertson, p. 20,

was often painted these colors, though it would seem that the washes may only be suggestions and not necessarily a record of existing treatments.

A long and careful study of the pattern books could reveal possible sources of designs for many other patterns and decorative parts making up the pastiche that defines transitional composite metalwork in the cemetery. The collage or "cut and paste" approach to design of the transitional metalwork is very much a symptom of the times. As the nineteenth century progressed there was ever increasing dissemination of information and semi-industrial processes were churning out parts in all styles that could be composed in any number of ways and in a variety of materials making the determination of precise sources of influence difficult at best.

Working from pattern books, pattern makers had to convert two dimensional line drawings to produce patterns in three dimensions for creating molds that served for casting. While this shows the genesis of the designs, only an exhaustive review of surviving manufacturer's catalogs might reveal the source of an actual pattern, mold or casting. With the widespread distribution of designs and liberal copying occurring internationally, the national origin of the patterns may be difficult to establish. This democratization of classically inspired artistic motifs was a defining characteristic of the nineteenth century made possible by increased communication, and new technology. The metalwork in the cemetery, and particularly the transitional composite metalwork, provides many examples of what the confluence of influences in nineteenth century New Orleans could produce.

While the importance of ornament was well appreciated, the approach used, namely mechanical replication, is precisely what Ruskin railed against. In his *Seven*

Lamps of Architecture, written in 1849, he characterizes ornament as having "…two entirely distinct sources of agreeableness: one, that of the abstract beauty of its forms…the other, the sense of human labour and care spent upon it." Cast or machine work was the third of what he referred to as "Architectural Deceits":

> The last form of fallacy which it will be remembered we had to deprecate, was the substitution of cast or machine work for that of the hand, generally expressible as Operative Deceit. There are two reasons, both weighty, against this practice: one, that all cast and machine work is bad, as work; the other, that it is dishonest.[161]

Ruskin's proclamation, if ever heard by the designers and fabricators of the cemetery ironwork, was certainly not heeded. If the transitional composite metalwork exists at all in the cemetery, it is precisely because of the relative cheapness of the process. While it certainly lacked the quality of hand work, it did seem to satisfy the local taste for crude ostentatious ornamentation.

The preponderance of similar crosses throughout the cemetery on the gates of the transitional metalwork can be explained by the likelihood that most clients did not know what they wanted to decorate the tomb of their loved ones. They were willing to rely on the suggestion of the artisan who would naturally reproduce what he knew: a proven design that had pleased others. He could personalize the design with small alterations, and make it efficiently and relatively cheaply.[162]

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[161] John Ruskin, *The Seven Lamps of Architecture*, New York: Dover Publications, Inc., 1989, the unabridged republication of the second edition published by George Allan, Sunnyside, Orpington, Kent in 1880, p. 53

[162] González Casarrubios, p.323

In the mid nineteenth century, zinc detail was used in the North in the form of rosettes and spacers cast separately and collars cast directly onto iron bars such as on the work surviving in the Laurel Hill Cemetery in Philadelphia. The designs are different from those in the St. Louis Cemeteries, not as sophisticated and the use much more restrained. All parts of the country were experiencing the same phenomena permitting a great freedom of expression. Each region applied these differently and in New Orleans it occurred with great exuberance.

Chapter 7. SOCIAL AND ECONOMIC CONTEXT

New Orleans remained essentially French after its transfer to Spain in 1763. Spain did not have the economic wherewithal nor the population required to fully colonize and thereby dominate the existing French culture. Besides, they shared many traditions rooted in Latin culture, monarchy, Roman law and Catholicism, which helped to assimilate the Spanish. In contrast, the American take over in 1803 was felt as a total invasion by the locals in all aspects of life. Americans came in great numbers, loud and domineering. They brought with them democratic principals, English common law and language and the Protestant work ethic.[163] The local population reacted in self-defense by retreating into isolation, both physical and cultural, by attempting to fend off the American influences and defining for themselves a distinguishing identity. The native population came to refer to themselves as "creole" meaning Louisiana born, but also came up with the further defense of claiming a cultural superiority over the invaders:

> In the veins of the creole, the myth assures us, ran the blood of those intrepid servants of the Bourbons who planted the French lily along the banks of the Mississippi as nobles of the robe or as young cadets in the military service of the crown, mingled perhaps with that of courtiers who had come as officers in the regimes of later Spanish governors. This 'race of proud and arrogant men,' we are told, produced 'the aristocrat of the region' through most of the nineteenth century, maintaining family circles renown for haughty exclusivity as well as cultural refinement and worldly sophistication, the whole

[163] Joseph G. Tregel, Jr., Creoles and Americans, In *Creole New Orleans: Race and Americanization*, Hirsh, Arnold R. and Joseph Logston, Editors, Baton Rouge, LA: Louisiana State University Press, 1992, p.133-134

> invigorated and sustained by fierce conceit of ancestry and a 'chivalry' which gave its inheritors certainty over lesser breeds of men.[164]

The dividing line between the creole and American communities came to be Canal Street. The creoles worked to maintain their cultural identity in any way they could, developing their innate "delicate and penetrating refinement". While the accuracy of this image of themselves is contested by Tregel in his article on Creoles and Americans, he may have identified the impetus for the creation of particularly exuberant ironwork for the cemeteries during this time. The surviving Protestant section of the cemetery has no such "refinement" expressed in metalwork.[165] The apparent fact of the uniqueness of this expression in metal to New Orleans could be explained at least in part in terms of being a symptom of the reaction of the creoles to the American invasion. It could also simply be a natural difference in expression stemming from a strong Latin tradition. An 1845 account of the cemetery confirms the dominant French presence in the cemetery: "The square on St. Louis Street is principally appropriated to natives of France and their descendents...Tombs are often embellished with fresh flowers, that look as if they received daily attentions."[166]

The roots of the industrial revolution extend back at least into the eighteenth century with changes in means of production leading to progressively greater quantities of goods. It wasn't until the middle of the nineteenth century, with the

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[164] Tregel, p. 134-136

[165] I have been cautioned that the bulk of the Protestant cemetery was moved by 1838 to the Girod Cemetery, which was in turn destroyed without documentation. What little is known, is that the tombs were quite grand, in keeping with the "American" architecture of 1830-60. (Ann Masson).

[166] B. M. Norman, *Norman's New Orleans and Environ: Complete guide to all subjects of interest in the southern metropolis*, New Orleans, LA: B. M. Norman, 1845, p. 107

advent of international expositions and increased international contact that people became aware that a new common system of processing materials had come into being. This new consciousness was to have a profound effect on artistic expression. In his *Art and Technology in the Nineteenth and Twentieth Centuries*, Pierre Francastel attempts to clarify the influence mechanization had on artistic expression.[167] Initially the influence of the machine was resisted and old forms persisted. As always occurs with the introduction of new technologies and materials, they are applied in ways that do not take full advantage of all they have to offer in terms of improved performance and different sensual qualities until these are better understood and accepted. It wasn't until later in the nineteenth century that metallurgy and the new machine-driven means of production were sufficiently mastered to allow consciously applied experimentation resulting in truly new forms of expression. Initially, Francastel argues that while even the most reactionary forces had to admit that industrialism was a necessary evil, there needed to be "reconciliation" between art embodying older values and industry. While there could no longer be a hereditary aristocracy, there could at least be one based on ideas and wealth. Drawing on exclusive traditional precepts, society's privileged class would maintain art as an elite expression, and the masses would accept it:

> For generations, creative activity in the modern world had no champions. The proletarian masses made poor champions because, in the end, they suffered from an inferiority complex and only dreamed of someday attaining the same advantages and outward lifestyle as their exploiters – at a lower price.[168]

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[167] Pierre Francastel, *Art & Technology in the Nineteenth and Twentieth Centuries*, Translation by Randall Cherry, New York: Zone Books, 2000, Chapt. 1, Myths of Mechanization, pp. 29-86
[168] Francastel, *Art & Technology*, p. 36

The transitional composite metalwork of the St. Louis Cemetery No.1 was more of a French New Orleans version of an American middle class conception. It evolved during the transitional period between pre-industrial modes and the end of the nineteenth century when industrial technology was better understood and minds began to open up to non-traditional expression. The contemporaneous elite expression was much more subdued and was represented in the relatively sophisticated works of the French Romantic architect de Pouilly. Both forms of expressions drew directly on past precedent for symbolism, motifs and similar manufacturing technologies. The big difference between the two was that of approach - an unconscious improvisation of the middle class versus formal composition of the elite, and in the choice of materials - cast zinc and wrought iron versus cast iron or the more distinctive bronze. While it may have been unconscious, the creators of the transitional composite metalwork, with their acceptance of new materials and methods, contributed to the emergence of a new more experimental attitude toward the relationship between industrial means and artistic creativity.

The likes of William Morris in England with his Arts and Crafts movement, the Union Centrale des Arts Décoratifs in France and the Dusseldorf school in Germany all denied the possibility of creating new aesthetics with new means and advocated a return to pre-industrial ideals,[169] while others allowed themselves to fall under the spell of the industrial mode:

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[169] Francastel, *Art & Technology*, p. 44

> Quickly, however, a new theory was formulated in which, rather than identifying their output with classical beauty, they lay down the principle whereby beauty was no longer immutable, because it varied over time, according to technological means, customs and social ideology.[170]

Etienne Souriau referred to his father Paul's doctrine of industrial artistic expression of 1904 as "integrated art". Here was the germ for a truly modern expression valuing and exploiting the new aesthetic created by a direct translation of the power of the machine. The transitional composite metalwork was certainly closer to this machine aesthetic than its contemporary classically inspired counterpart, which was still clinging to traditional forms and methods. The application of new materials and technologies, such as the casting of zinc with metal molds directly on to the wrought iron armature, while still imitating traditional forms, nevertheless tacitly accepted the validity of these new means. Later movements consciously integrated mechanical means while developing new forms of expression, though with widely varying results: Art Nouveau adapted industrial methods to producing an organic flow and decor based in biological forms. This was in total contrast to the later outgrowths of Adolph Loos's dogma, which advocated the elimination of ornament altogether to reveal the "soul" of the machine.[171]

There are no known surviving records of transactions for metalwork for the cemeteries. These may have been rare to begin with. The metal work was contracted separately from the tombs and oral agreements were probably made directly between

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[170] Francastel, *Art & Technology*, p. 45

[171] Francastel, *Art & Technology*, pp. 45-46

the client and craftsman. The tombs were used intensely with the rotation of bodies through the years. Rehabilitating existing family tombs with ironwork was a natural expression of attention and the desire by family members to keep up with the times.

There is very little consistency in dimensions, stock sizes and detail of fabrication from one metal tomb enclosures to another, even within the same design types. This could indicate that:

- Many different shops were providing work for the cemetery and/or
- The shops that were contracted for work received orders only sporadically, not warranting the fabrication of tooling and standardization of detail that greater demand and production in series would require and/or
- The shipments of bar stock were sporadic and shops were required to use whatever stock they had available at the time of the order and
- The metalwork was often, if not always, retrofitted to existing tombs, which were all of differing sizes, requiring the metalwork to be custom made for each

The Customs manifests show no record of shipments of any metal goods from France in the first quarter of the nineteenth century, though roofing tiles were being sent from there during this time. [172]

Wrought iron was being supplied to New Orleans from New York and Boston. The Priestley & Bein Co. of New Orleans was advertising steel from Pennsylvania and Tennessee, but the greatest amount by far in the 1820s and 30s was coming from

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[172] Customs Manifest – Federal Archives, N.O.L.A., 1806-1831. From: Masson personal research files

Liverpool, and directly or indirectly, from Sweden. The iron industry was still a struggling one in this country.

The starting point for the use of zinc in New Orleans can not predate 1812, the practical production of zinc in Europe. The indication that zinc was being offered for sale in the 1830s, a commodity not picked up by U.S. Customs, means that it could have been coming into New Orleans earlier still and unnoticed. This would support the argument, from a stylistic standpoint, that the transitional metalwork with its extensive zinc ornament could have been made as early as the first quarter of the nineteenth century.[173]

The well-known New Orleans historian Samuel Wilson, Jr., in his October 1948 article on New Orleans ironwork makes no mention of zinc detail even though cast zinc detail is such a prominent feature in transitional composite metalwork.[174] He affirms that wrought iron was still in regular use through the 1840s and that 1850 marked a turning point with a radical shift to the widespread use of cast iron. The 1849 cast iron Rococo Revival verandahs for the Pontalba Buildings helped start the trend to cast iron. We know from the signed work by Lehec, that the transitional metalwork with its composite materials and manufacture coexisted with cast iron work at least until the 1860s.

There has been a long standing prejudice against zinc as a material in decorative applications or any application. It was principally used in imitation of other more noble materials with coatings applied and was therefore hidden from view. Zinc

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[173] Ann Masson, interview on New Orleans Metalwork and Stylistic Influence, Feb. 18,2002
[174] Samuel Wilson, *New Orleans Metalwork*, Magazine [ ], Oct. 1948, p. 214-217

earned a bad reputation because of its brittleness and the unappealing grey oxide it develops when left uncoated, but also probably because its metallurgy was not well understood. Even the smallest amounts of impurities could negatively affect its performance making it very brittle in its cast form and easily breakable. Other reasons for it not being recognized are its easy confusion with lead and it being hidden by paint or by coatings of iron oxide from contiguous unpainted and corroding wrought iron. These may be reasons why it was not acknowledged as a contributory element in the ironwork in New Orleans.

CONCLUSION

The metalwork in St. Louis Cemetery No.1 categorized as "transitional composite metalwork" is a mid-nineteenth century expression native to New Orleans shaped by unusually rich influences. It is *transitional* in the sense that it displays evolving means of production by including traditional handwork combined with proto-industrial means of manufacture; it makes simultaneous use of traditional and new materials and reflects the evolving stylistic influences of the period. The *composite* aspect of the metalwork is embodied in the concurrent use of varying means, materials and aesthetic influences.

The St. Louis Cemetery No.1 with its very diverse collection of metalwork was the beneficiary of what has been described as "the Battle of the Styles," with

designers' pattern books and factory production defined by an eclectic repertory.[175] It was a forum for the shift from traditional to industrial technologies and for the novel application of zinc, a new material with little precedent as applied ornament for architectural detail.

Further research might better define the design and technical influences and the time period of manufacture, now only tentatively established as being between 1820 and 1860. It is hard to determine, with the information now at hand, what had more impact on the design of transitional metal work - a new machine aesthetic developed by the designers from their understanding of new materials and industrial means - or the contribution made by metal workers with a predominantly industrial training. A strong interplay of both is likely, with each simultaneously learning about the qualities and limitations of the new materials and means of the nineteenth century. Cast iron was undergoing intense experimentation as a new medium of artistic expression using industrial means. Zinc, a new, but also more accessible material because of its lower melting point, was no less put to the test. Additional inquiry into the personal histories of those responsible for the work in the cemetery and a search for similar work elsewhere will provide the context to more fully understand the relative importance of all contributing factors.

The process of preservation will provide intimate contact with these remarkable examples of human creativity. Insights gained from the process could inform new work after a century long hiatus and revitalize a rich local heritage of evolving expression in metal.

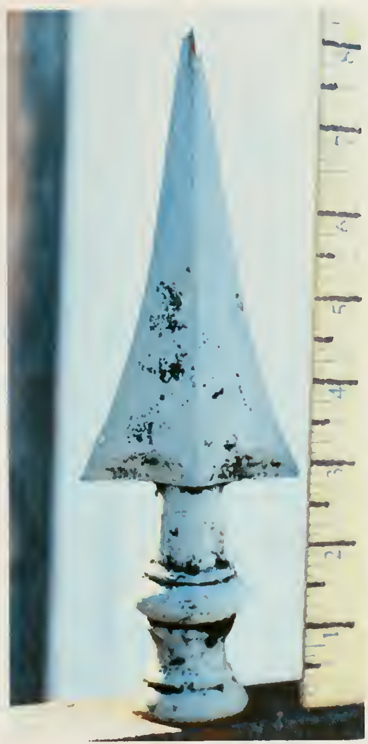
[175] Harris, p. 13

APPENDIX – A

CATALOG OF ORNAMENT

Plates 1A – 38A

All photographs were taken by the author unless otherwise noted. The full references for the images used can be found in the accompanying bibliography.



Pl. 1A

Designation: **SP-1**, Spear Point

Material: Cast Zinc

Examples: Fleitas # 143, Chategnier #491, Lacombe # 564, Brown/Fernandez/Labranche #568

Typology: First Republic/Directoire/Empire, Empire Vernacular

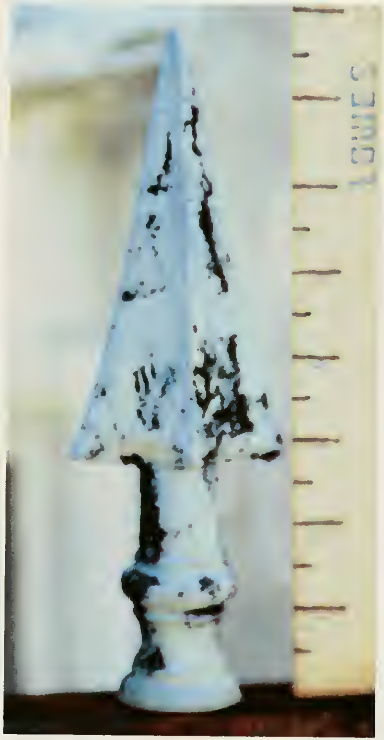
Details: Height is 8 1/4 inches. The faces of the point are flat. Reinforced with the forged tapered end of the wrought iron picket.

Sources: Inspired by Roman period representations such as this 3rd Century Roman sarcophagus:

Lehman, p. 43

Pl. 2A

Designation:	**SP-2**, Spear Point
Material:	Cast Zinc
Examples:	Rivoil # 300, Baquie # 301, Morphy # 366, Longer #472
Typology:	First Republic/Directoire/Empire, Empire Vernacular
Details:	Height is 8 1/4 inches. The faces of the point are concave. Reinforced with the forged tapered end of the wrought iron picket. Note crack with exposure of rusting wrought iron. A complete period mold survives. Sources:The spear heads come to a very sharp point. They serve not just as adornment, but also as protection for the tomb. The only other applications they see is on the top rail of tall grillwork and gates where they serve the same purpose. In general use on low railings they are seen as too threatening. Even in the cemetery there are cases where the points have been deliberately bent over. See **SP-1** for its classical origin.



Pl. 3A

Designation:	**SP-3**, Spear Point
Material:	Cast Zinc
Examples:	Veau et Boulet #235
Typology:	First Republic/Directoire/Empire, Empire Vernacular
Details:	Height is 8 inches. The faces of the point are concave. Reinforced with the forged tapered end of the wrought iron picket.
Sources:	See **SP-1**. Shown below is one of a series of molds recovered in an old shop in New Orleans possibly used for the casting of this zinc spear point. The mold is cast iron bolted to a pair of wrought iron tongs with the sprue at the wide end.

Use of the mold courtesy of James Stoyanoff

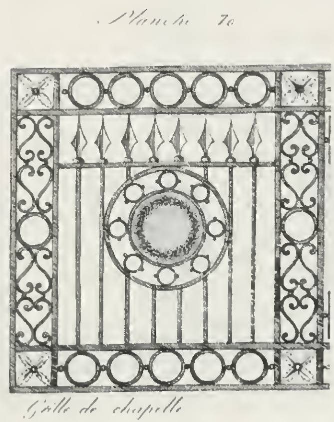
Pl. 4A

Designation:	**SP-4**, Spear Point
Material:	Cast Zinc
Examples:	d'Aquin/Ramos #422, Perrault #351
Typology:	First Republic/Directoire/Empire, Empire Vernacular
Details:	Height is 6 1/4 inches. The faces of the point are concave. Reinforced with the forged tapered end of the wrought iron picket.
Sources:	An 1830 representation of Napoleon's tomb in the British island of Saint Helena shows a similar spear point on the wrought iron pickets of the tomb enclosure:

Madelin, p. 147

Pl. 5A

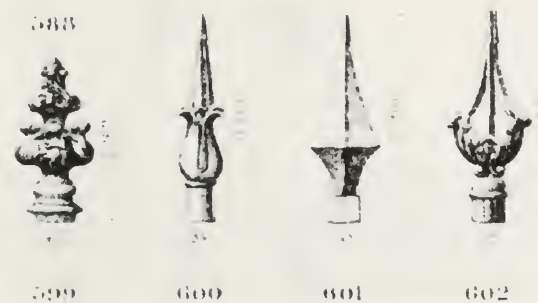
Designation:	**SP-5**, Spear Point
Material:	Cast Zinc
Examples:	Crescioni #1500, Cocke # 1000
Typology:	First Republic/Directoire/Empire, Empire Vernacular
Details:	Height is 4 inches. The faces of the point are concave. Reinforced with the forged tapered end of the wrought iron picket or tapered and threaded rod for fastening into top rail. A complete period mold survives.
Sources:	See **SP-1**. This defensive element was otherwise only used to cap tall grills and gates, or for in-fill ornament:



Berthaux, Pl. 70

Versaille, grille de l'avant-court
Clouzot, p. 188

Designation: **SP-6**, Spear Point
Material: Cast Zinc
Examples: Bergamini #12
Typology: Spanish Rejas
Details: Height is 5 1/2 inches. Reinforced with the forged tapered section of round bar, which is threaded where it protrudes from the finial. The finial screws into the top of the post through the top rail to hold the rail in place. This point has been blasted with walnut shell and coated with a microcrystalline wax tinted with carbon black. Half of a period mold survives.
Sources: In the mid 19th-C the Paris-based Barbezat & Cie. produced many varieties of cast iron spear points of different styles and for varying degrees of aggressive posturing:

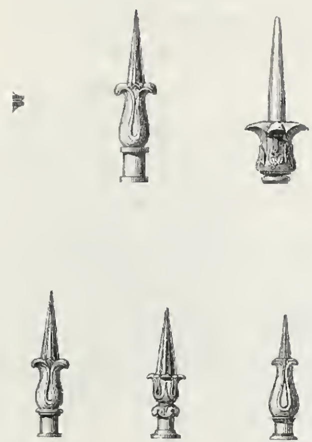


Lances et Fleurons
Catalogue Societe Anonyme des Hauts Fourneaux & Fonderies du Val d'Osne, (succ. To Barbezat)

Pl. 6A

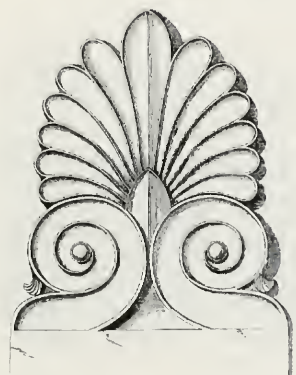
Pl. 7A

Designation: **SP-7**, Spear Point
Material: Cast Zinc
Examples: Perilliat #162, de Marigny #606, Parker #541, Locoul #493
Typology: First Republic/Directoire/Empire
Details: Height is 6 1/4 inches. Reinforced with the forged tapered section of a round bar, picket fed through the top rail
Sources: Picket points of very similar design are in the Denonvillier Catalog of iron work designs, Plate 41, "Railing Ornaments":



Denonvilliers, Pl. 41

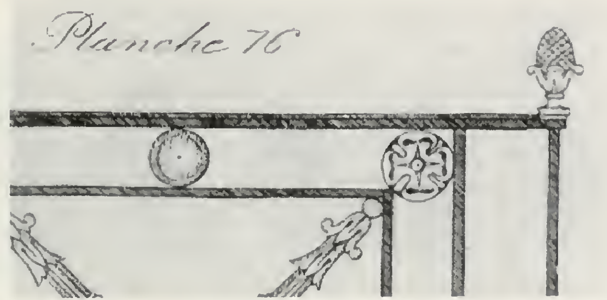
Designation: **F-1**, Finial
Material: Cast Zinc
Examples: Bergamini #12
Typology: Spanish Rejas
Details: Anthemion. Height is 5 1/2 inches. An unfinished casting reinforced with a forged section of round bar threaded where it protrudes from the finial. The finial screws into the top rail. This has been blasted with walnut shell and coated with a microcrystalline wax tinted with carbon black. A whole period mold survives.
Sources: Starting in the 18th-C, the western world became infatuated with classical motifs. The Greek anthemion was a favorite ornament freely interpreted and adapted in the Greek tradition as applied ornament.



Termination of the Marble Tiles of the Parthenon
Owen Jones, p. 46

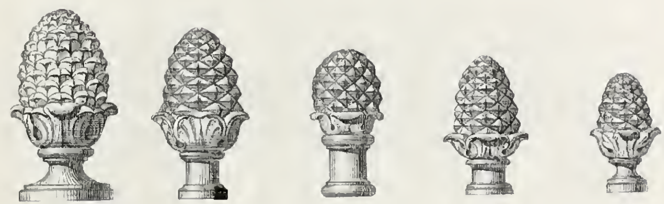
Pl. 8A

Designation:	**F-2**, Finial
Material:	Cast Zinc
Examples:	Bergamini #12
Typology:	Spanish Rejas
Details:	Pine Cone with acanthus leaf. Height is 5 1/2 inches. Cast-on a section of round bar threaded on the protruding end. The finial screws into the top of the corner post through the top rail to hold the latter in place.
Sources:	First appeared under Louis XVI and was used through Louis Phillip, late 18th C – Mid 19th C. Models are shown in Bury's *Modele de Serrurerie Choisie*, 1826, Pl. 3 and Berthaux's *Le Parfait Serrurier* of 1841, Pl. 76 and Pl. 91:



Pl. 9A

Designation: **F-3**, Finial
Material: Cast Zinc
Examples: Cocke # 1000
Typology: Vernacular
Details: Pine Cone in acanthus leaves. Height is approximately 3 3/4 inches. Cast-on a section of round bar threaded on the protruding end. The finial screws into the top of the corner post through the top rail to hold the rail in place.
Sources: The L. Denonvillier company, Paris published *Fontes de fer de toutes especes*, a catalog of 1,100 design in 1900. There is a series of very similar pine cones shown in Plate 64 entitled "Banister Knobs".

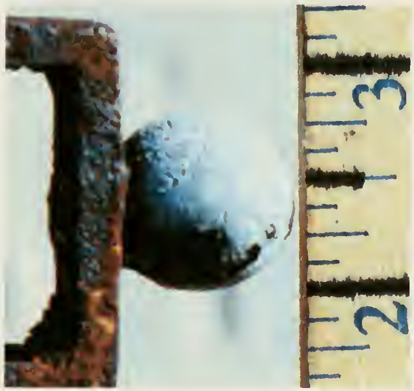


Denonvilliers, Pl. 64

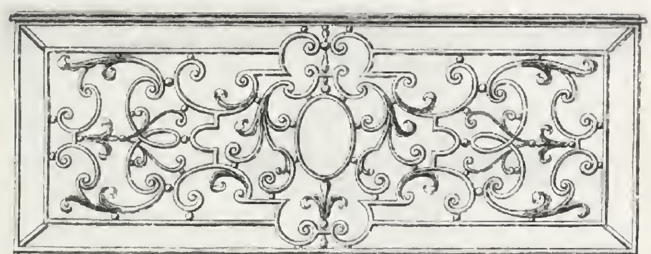
Pl. 10A

Pl. 11A

Designation:	**F-4**, Finial
Material:	Cast Zinc
Examples:	Musson #193
Typology:	Vernacular
Details:	Urn with flame. Height is approximately 7 inches. Reinforced with a section of round bar threaded where it protrudes at the base. The finial screws into the top of the corner post through half lapped top rail to hold the latter in place. The pronounced seam shows the configuration of the two part mold used to cast the finial, which is designed to accommodate the axial wrought iron rod.
Sources:	L. Denonvillier company, *Fontes de fer de toutes especes*, Pl. 84, "Tomb Enclosures" shows flaming urn finials at the corners of similar enclosures as those found in St. Louis No. 1. This is a common 19th C motif for funerary decor along with the inverted torch found elsewhere in the cemetery. Berthaux's *Le Parfait Serrurier*, Pl. 77 has flame finials at the corners of typical tomb enclosures.



Designation: **BS-1**, Ball Spacer
Material: Cast Zinc
Examples: Veau/Boulet #235, Auguste # 238, Perrault # 351, Debreuil #573
Typology: Louis XVI Revival, Vernacular
Details: Ball spacer or “perles” used as a decorative end piece on a cross in a vernacular application, (Veau) or more often as a spacer to avoid tangential lines and help articulate the different elements of a designthereby lightening the overall effect. In both cases they are drilled through and held in place with a wrought iron rivet. These can be ovalized by filing opposite ends, or cast oval.
Sources: First came in frequent use under Louis XV in the first part of the 18^{th} C, was used less in the beginning of the 19^{th} C and returned with the revival of the Louis styles.

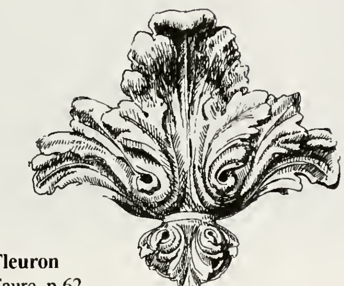


Louis Fordrin, early 18^{th}-C
Blanc, Pl. 11

Pl. 12A

Designation:	**T-1**, Zinc Terminal
Material:	Cast Zinc
Examples:	Debreuil #573
Typology:	Louis XVI Revival
Details:	"Fleuron" motif, fastened with a wrought iron rivet forming the terminal for a pair of scrolls. This is the only example of its kind in the cemetery. A cast iron terminal with a fleur de lis motif is used in the same application on the Auguste #238 enclosure.
Sources:	A tri partite flower motif referred to as a "fleuron" came into use with the Louis XV style of wrought iron work in the form of repousee sheet metal. This form was incorporated in cast composite ornament during the 1er Republique-Empire periods of the late 18^{th} and early 19^{th}-centuries.

Place Stanislas, mid 18th-C
Jean Lamour
Clouzot, p. 271



Fleuron
Faure, p.62

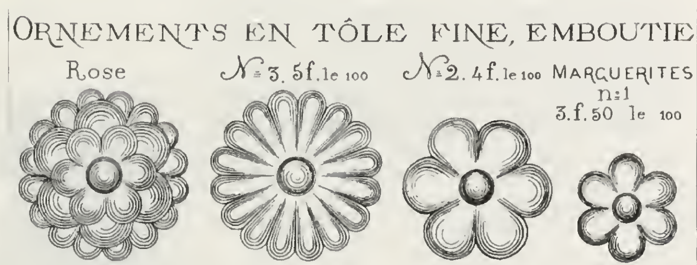
Pl. 13A

Clouzot, p. 188

Designation: **T-2**, Cast Iron Terminal
Material: Cast iron
Examples: Auguste # 238
Typology: Louis XVI Revival
Details: Fleur de lis motif, fastened with a wrought iron rivet forming the terminal of two scrolls.
Sources: Emblem of French Royalty dropped from use after the French revolution making only a rare appearance with the revival Louis styles. This could have been a deliberate statement of French identity on the part of the maker William Lehec or the Auguste Family.

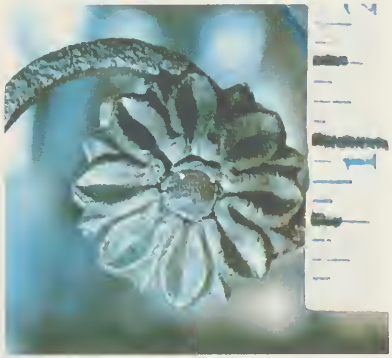
Pl. 14A

Designation: **R-1**, Zinc Rosette
Material: Cast Zinc
Examples: Bermudez #35, Auguste # 238, Perrault # 351, Debreuil #573
Typology: Louis XVI Revival, Vernacular
Details: Daisy motif, fastened with a wrought iron rivet forming the central hub of the flower.
Sources: This is a basic and common design offered in sheet metal in the second half of the 19th-C to fabricators by such French firms as the Maison R. Garnier, Paris, Pl. 402 and in H. Grave's pattern book and catalog, "Ornements en tole fine, emboutie".



H. Grave

Pl. 15A



RIVETED

Front

CAST-ON

Back

Pl. 16A

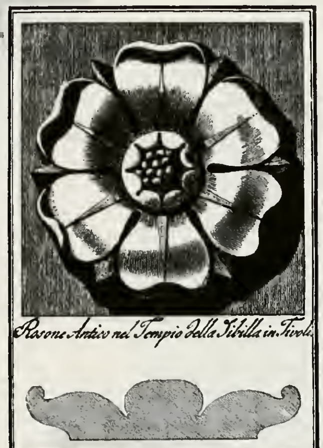
Designation: **R-2**, Zinc Rosette
Material: Cast Zinc
Examples: Bergamini #12, Veau/Boulet # 235, August # 238, Cousin #243, Perrault # 351
Typology: Empire, Louis XVI Revival, Spanish Reja, Empire-Vernacular
Details: 1 5/8 inch diameter. This design of rosette is the most widely used throughout the cemetery and found on almost any type of transitional metalwork. It is either directly cast-on the wrought iron at an intersection to act as a clamp holding the metal together, (Bergamini), or, as is mostly the case, is riveted on through a scroll end.
Sources: Could be derivative of one of the many models for rosettes found in a number of pattern books from the 19th C, such as Thomas U. Walter's *Guide to Workers in Metals*, Pl. LII, or L.N. Cottingham's *Smith and Founders Director*, Fig. 291, "Rosettes and wreath" or supplied by a company like the L. Denonvilliers firm, Paris

Pl. 17A

Designation:	**R-3 and R-3R**, Zinc Rosette
Material:	Cast Zinc
Examples:	Fazende #20, Saulet #46, Locoul #493, Dubreuil #573
Typology:	Louis XVI Revival, Empire-Vernacular
Details:	3 inch diameter. This design of rosette is either directly cast-on the wrought iron at an intersection to act as a clamp holding the metal together, (Dubreuil shown here), or is riveted on. The lower photo shows the reverse, a different design in a two part mold when cast-on.
Sources:	The molds required by the fabricators of the metal work in the cemetery for this kind of cast-on application could have been supplied by a French Firm such as advertised in H. Grave's 19th-C pattern book *Le Nouveau Serrurier*. They could also have been made locally given the expertise that existed in the foundries in New Orleans.

Designation:	**R-5**, Zinc Rosette
Material:	Cast Zinc
Examples:	
Typology:	Louis XVI Revival, Empire-Vernacular
Details:	1 ½ inch diameter. This rosette is rare and is only riveted on.
Sources:	An almost identical design is represented in the Denonvilliers catalog, Pl. 54, suggesting that a cast iron version may have been available from a supplier of ornamental detail. Local shops could use an original cast iron sample as a pattern and pour copies in zinc in sand. Similar designs for rosettes are also found in Thomas U. Walter's *Guide to Workers in Metals*, or L.N. Cottingham's *Smith and Founders Director*, which in turn would have been inspired by Roman detail.

L. N. Cottingham, Fig. 291



Antonini, p. 12

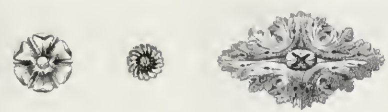
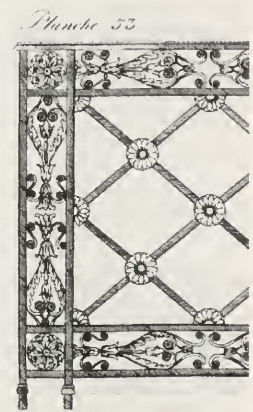


Plate 54. Detached Rosettes

Pl. 18A

Designation: **R-6**, Zinc Rosette
Material: Cast Zinc
Examples: Veau/Boulet #235
Typology: Empire-Vernacular
Details: 2 ¼ inch diameter. This rosette is only riveted on and used exclusively at cross intersections. A mold survives. Similar to R-7, but less sharp.
Sources: Probably based on one of the many models for rosettes found in a number of pattern books from the 19th C. Louis Berthaux's 1841 pattern book shows rosettes both applied to intersections of bars and used as in-fill.

Berthaux



Pl. 19A

Designation:	**R-7**, Zinc Rosette
Material:	Cast Zinc
Examples:	Saulet #46, Bright/Hinck #126, Musson #193
Typology:	Empire-Crossed Bars, Vernacular
Details:	2 ¼ inch diameter. This rosette is only riveted on, used at cross intersections and applied to scroll ends. It is very similar to R-6, except that it is cut deeper and has more definition. A mold survives.
Sources:	Appears to have been based on this model for a rosette found in L.N. Cottingham's *Smith and Founders Director* also published in Thomas U. Walter's *Guide to Workers in Metals*.

L. N. Cottingham. Fig. 291
Gloag. p. 234

Pl. 20A

Designation:	**R-8**, Zinc Rosette
Material:	Cast Zinc
Examples:	Pandely #281
Typology:	Empire-Vernacular
Details:	2 ¼ inch diameter. This rosette is rare and only used riveted at cross intersections. The same rosette was used on both sides. Some sort of blocking was required behind the rosette in the square formed by the wrought iron to back up the brittle zinc during riveting and to keep the rosettes centered.
Sources:	This design was probably derived from the many models for rosettes found in of pattern books from the 19th C. Cast iron rosettes purchased from suppliers could easily have been used as patterns for casting molds in bronze or cast iron for then casting imitations in zinc. The period molds recently found were made in both cast iron and bronze. The latter was more fragile, but had the advantage of holding heat longer. No maker's marks were found on the molds, which could suggest a pirated design.

Pl. 21A

Designation: **R-9**, Zinc Rosette
Material: Cast Zinc
Examples: Perrault #351
Typology: First Republic/Directoire/Empire
Details: 2 ¼ inch diameter. This rosette is found only on a small number of tombs in varied applications. On the Perrault tomb, (above), it has been adapted as a cover plate for a lock. Note center key hole. It is also used at several cross intersections. Below it is painted with gold paint to set it off from the wrought iron cross.
Sources: This does not have the classically derived detail of the other rosettes. It has similar elements to rosettes found in Walter's *Guide to Workers in Metals,* Pl. LII, namely separate flowers and leaves forming a composite whole:

Pl. 22A

Rear view of terminal

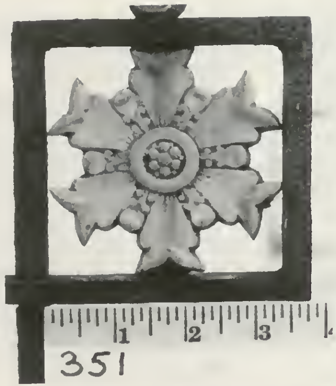
Pl. 23A

Designation: **T-3**, Zinc Terminal
Material: Cast Zinc
Examples: Perrault #351
Typology: First Republic/Directoire/Empire
Details: 4 inch long with limited iron reinforcement for attachment to the gate. The leverage its length provides has made it an easy target for vandals. This terminal is found only on two tombs in two different applications. On the Perrault tomb, (above), it has been adapted as a kind of gate handle and decorative terminal throughout the composition of the gate including the extremities of the cross.
Sources: This design could have been inspired by motifs in any number of 19th-C pattern books. Louis Berthaux's *Le Parfait Serrurier* shows a frieze motif while not as fine, contains the same basic elements as this, (Pl. 64, See **Arrow** designation). *Planche* 73 shows similar feather-like terminals on cross ends.

Designation: Top: **R-10**, Zinc Rosette, Bottom: **R-11**
Material: Cast Zinc
Examples: Top: Perrault #351, Bottom: Bermudez #35
Typology: First Republic/Directoire/Empire
Details: Top: 2 ¼ inch dia., an angel framed by rays Bottom: approx. 5 in. in dia., a sun face.These are the only rosettes of their kind surviving in the cemetery.
Sources: Faces are occasionally incorporated in the designs of French ironwork dating back to the 17th-C with the obvious precedent of Louis XIV's "sun-king" motif. Several examples are found in Berthaux's *Le Parfait Serrurier*. The same ray-framed faces are used along with other symbols of power during the 18th-C under Louis XVI, (Faure, p. 76). Here the symbolism presumably has more to do with redemption.

Le Roi Soleil
Versailles
Clouzot, p. 188

Pl. 24A

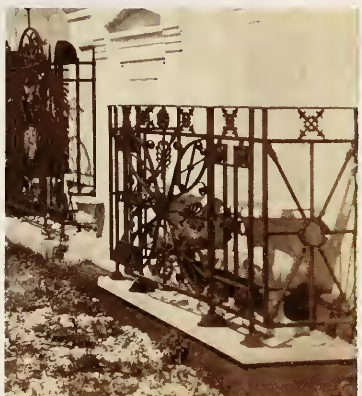


Designation: **R-12**, Zinc Rosette
Material: Cast Zinc
Examples: Perrault #351
Typology: First Republic/Directoire/Empire
Details: 3 ½ inch width with an iron pin cast vertically in the core of the zinc medalion for attachment. Four of these are incorporated in the design of each panel flanking the gate. They were used on other enclosures in St. Louis No. 1 that do not survive, (Desban # 157)
Sources: This is an obvious representation of the Legion of Honor, the decoration initiated by Napoleon Bonaparte in 1804 awarded to those providing exceptional service to the French nation. It has been modified here with the addition of a sixth pedal to accommodate the means of attachment. Below is a portrait with Bonaparte wearing the order he created. Had Auguste Perrault been honored with the award?

Madelin, p. 105

Pl. 25A

Designation: **R-13**, Zinc Rosette
Material: Cast Zinc
Examples: Auguste #238, Dubreuil #573
Typology: Louis XVI Revival
Details: 3 ¾ inch square with two iron pins cast diagonally in the core of the zinc ornament for attachment. These ornaments are incorporated in a frieze running around the whole of the Auguste enclosure for a total of nine. They were used on other enclosures in St. Louis No.1 that do not survive, (Desban # 157) or only partially, (Dubreuil # 573)
Sources: This particularly delicate ornament was undoubtedly inspired by models available in the pattern books of the 19th-C. There is the possibility that its use is another signature of William Lehec, the blacksmith whose label was found on the Dubreuil metal work. His is the finest and most elaborate of the work in the cemetery.



Center Aisle, St. Louis No. 1
Louisiana State Museum Collection
S. T. Blessing Photographer, ca. 1875
1979.120.122

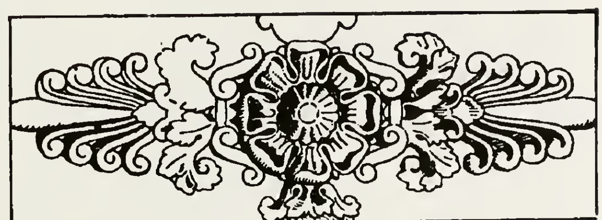
Pl. 26A

Designation: **R-14**, Zinc Rosette
Material: Cast Zinc
Examples: Crescioni #1500
Typology: First Republic/Directoire/Empire
Details: 6 inches point to point. This is a one-of-a-kind ornament covering the intersection of the converging wrought iron bars. The rosette on the Crescioni tomb has been broken. This is an identical complete rosette found in St. Louis Cemetery No.2.
Sources: The points on this rosette have the exact same configuration as the terminal **T-1** found on the Dubreuil #573 metal work. Here they have been incorporated in a larger composite ornament. It is not clear whether these ornaments were bought ready for installation from a supplier or if the molds were purchased and the ornament was cast by the fabricator. A third possibility is that the designing, carving of the patterns and casting of the molds all occurred locally. See **R-15**

Terminal T-1

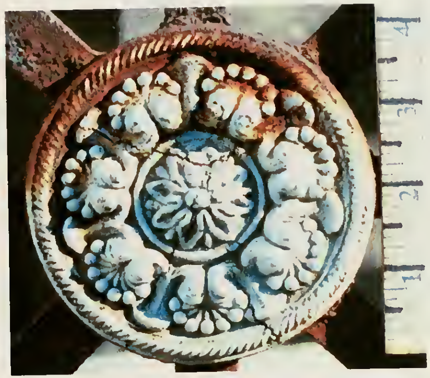
Pl. 27A

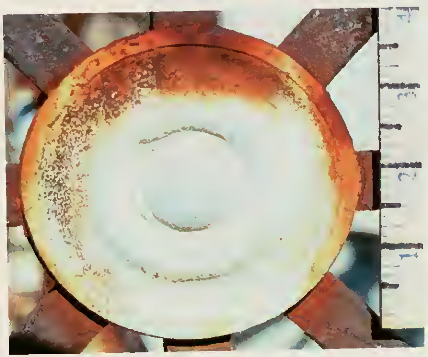
Designation:	**R-15**, Cast Iron Rosette
Material:	Cast Iron
Examples:	Auguste #238
Typology:	Louis XVI Revival
Details:	6 inches point to point. This is a one-of-a- kind in-fill ornament installed between vertical bars of the front side panels of the August enclosure.
Sources:	The points on this rosette have the exact same configuration as the terminal **T-1** found on the Dubreuil #573 metal work and on the Crescioni central composite rosette. See **R-14**. The 19th-C brings heavy classically inspired motifs in cast iron, applied ornament that had previously been executed in sheet metal.



Early 19th-C Cast Iron
Hotel des Cariatides,
Nantes
Lecoq, p. 64

Pl. 28A





Pl. 29A

Designation: Top: **C-1,** *Coupelle Moulee,* Bot: **C-2**

Material: Cast Zinc

Examples: Saulet #46, Locoul # 493

Typology: Empire – Crossed Bars

Details: 4 inch diameter. These are found throughout the cemetery as hubs for a crossed bar motif. They provide a mechanical fastening of the bars and were also meant to seal out water at the intersection. Most were cast directly on the bars, with a two part mold, others were cast in two pieces then riveted together. **C-2** is used for front and back.

Sources: This type of application has a precedent in the Pere Lachaise cemetery in Paris. The French Architect de Pouilly brought a compilation of designs by Quaglia for tombs in the Paris cemetery to New Orleans in 1833, which he used as a guide for his own designs. This included a preponderance of the "Empire-crossed bars" style of ironwork, with *coupelle* moulee, which in Paris were cast exclusively in iron. See **C-3**

Designation:	Top: **C-3**, *Coupelle Moulee*
Material:	Cast Zinc
Examples:	Saulet #46, Locoul # 493
Typology:	Empire – Crossed Bars, Louis XVI Revival
Details:	4 inch diameter. These are found as hubs for any convergence of bars. They provide a mechanical fastening of the bars and were also meant to seal out water at the intersection. These were cast directly on the bars, with a two part mold.
Sources:	Hubs or *coupelle moulee* of this sort were used extensively in the Pere Lachaise cemetery in Paris open in 1804. The Roman cross-bar motif was surely popular not only for its classical reference, but also because its simplicity kept it from competing with the detail of the stone work. Many examples of cross bar motifs with *coupelle moulee* exist in the period pattern books.

Pere Lachaise Cemetery
Brown, 1973

Collection of Drawings of Monuments in Pere Lachaise
Quaglia, Pl. 10

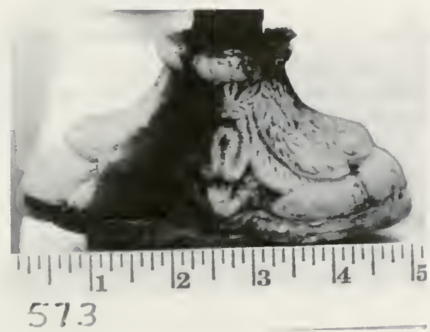
Pl. 30A

Pl. 31A

Designation: Top: **FL-1**, Double Flange
Material: Cast Lead
Examples:
Typology: Louis XVI Revival
Details: 6 inch in length. This is one design of several for covering the forged split ends of gate posts. The configuration of the split varied and the poured lead could accommodate these differences. The molten lead helped seal around the base at least for a while if it was poured properly. Otherwise water would infiltrate between the lead and wrought iron and cause corrosion and failure of the flange.
Sources: The split ends of the gate posts seem to be a standard detail providing additional bracing for the gate. This warranted the design and casting of specialized molds. Here again, pattern books would have provided motifs for the decoration of an element of such specific utility.

Designation:	**FL-2**, Double Flange
Material:	Cast Lead
Examples:	Perrault #351, Dubreuil #573
Typology:	First Republic/Directoire/Empire, Louis XVI Revival
Details:	5 inch length. These gate post flanges had to be cast on site. The split base of the gate posts were first set in lead in the marble threshold. A two part double hinged mold was pre heated and then clamped around the wrought iron. Molten lead was then quickly poured into the mold in one continuous pour to avoid layering and voids.
Sources:	While this was used on the Louis XVI type Dubreuil enclosure, the claw or paw termination is more in keeping with the 1st Republic/ Directory/Empire. The animal foot is a classic element in the repertoire of styles from the early 19th-C.

Animal motifs of the Empire Style
Queant, p. 145

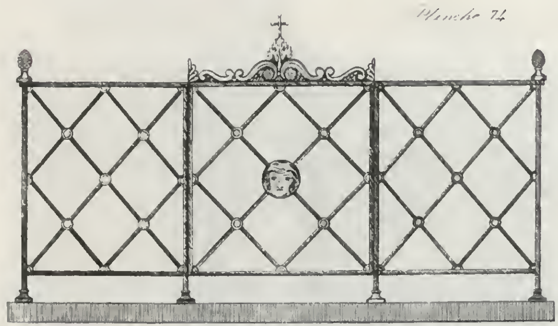


Pl. 32A

Pl. 33A

Designation:	Top: **FL-3**, Flange, Bottom: **FL-4** Flange
Material:	Cast Lead
Examples:	Almost all the railings in the cemetery
Typology:	N/A
Details:	2 ½ inch square. These were used to adorn the base of the corner or intermediate posts. Some are a little more elaborate than others, but most all railings had them regardless of type. The layering of the lead in the bottom flange comes from pouring in several takes and is a good indication that the lead flanges were poured on site with the railings in place. The greatest majority of the flanges failed due to galvanic corrosion occurring between the lead and the wrought iron.
Sources:	The pattern books show post flanges or bases as an integral element of design helping to seat the railing visually and with the practical advantage of covering the anchor hole and shedding water. (Berthaux, Pl.74, 77)

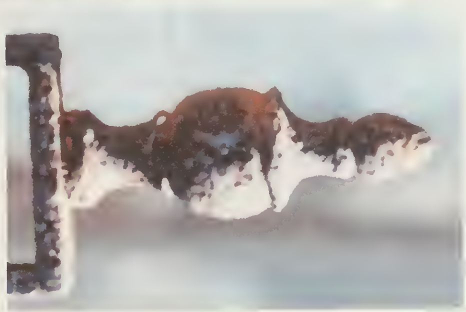
Designation: **FL-5**, Flange
Material: Lead
Examples: Dubreuil #573
Typology: Louis XVI Revival
Details: 3 inch square. This flange was poured once the railing was installed with what must have been a double hinged two part mold to fit around the post. No molds for flanges have been located to date.
Sources: The pattern books show post flanges or bases as an integral element of design helping to seat the railing visually and with the practical advantage of covering the anchor hole and shedding water. (Bury, Pl. 8, Walter, Pl. 78, Berthaux, Pl. 74, 77)



Berthaux, Pl. 74

Pl. 34A

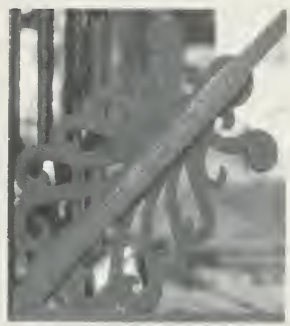
Designation:	**F-5**, Finial
Material:	Wrought Iron
Examples:	Bergamini #12, Perrault #351
Typology:	First Republic/Directoire/Empire, Spanish Rejas
Details:	Approx. 3 inches long. This finial was most likely forged with dies because sand casting such a small piece in the round would have been too trouble some. It could have been finished on a lathe or with a file. The base could have been drilled and tapped for a threaded rod and then screwed on to the cross extremities or riveted.
Sources:	A simple profile such as this could have been the blacksmith's own design. The subtle variations in the profiles of the two examples further suggests hand forging.



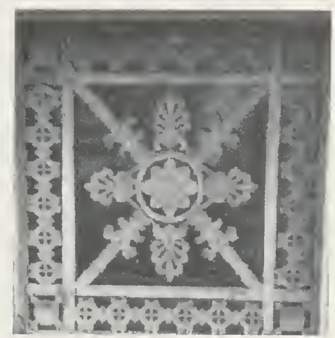
Pl. 35A

Designation: **Anthemion**
Material: Cast Iron
Examples: Perrilliat #162, Auguste # 238, Locoul #493
Typology: First Republic/Directoire/Empire, Louis XVI Revival
Details: Approx. 9 ¼ inches long. This is a simple, but delicate casting poured in a flat back sand mold. It was riveted on to a wrought iron bar forged with an approximate profile so as not to be seen from behind. The wrought iron backing provided needed reinforcement to a brittle material.
Sources: This is a classic Greek motif adapted from any number of examples found in all the pattern books of the period. This would have been a purchased applied ornament unless the shop had a regular cast iron production justifying the great expense of running a high temperature iron furnace.

Reverse



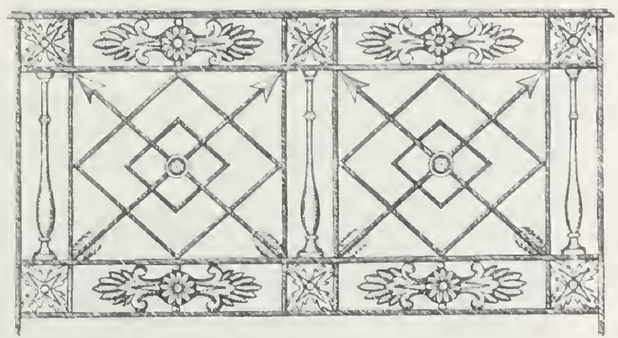
Pere Lachaise Cemetery
S. B. Curtis, 2001



Pl. 36A

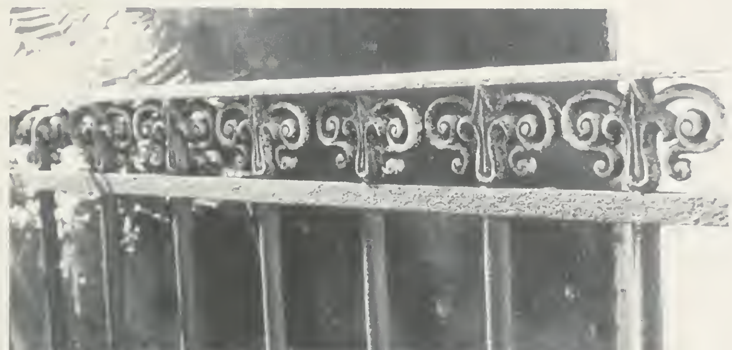
Pl. 37A

Designation: **Arrow**
Material: Cast Zinc
Examples: Perrault #351. Crescioni #1500
Typology: First Republic/Directoire/Empire,
Details: The feathers and points of the arrow were cast directly on to wrought iron round bar doubling as an armature for the brittle zinc and providing the tensile strength needed for anchoring to the gate frame.
Sources: The arrow was a classic Roman motif and a favorite of designers during Napoleon's rule. Along with the spear point, martial symbolism was incorporated at every opportunity. Examples abound in the 19^{th}-C patterns books:



Berthaux, Pl. 64

Designation:	**Frieze Motif**
Material:	Cast Zinc
Examples:	Musson #193
Typology:	Vernacular
Details:	This is a unique ornament for the cemetery. The zinc form is cast onto a central wrought iron pin for strength and for riveting to the top and bottom rails of the frieze. The zinc has a blue-green tinge to it, different from all the other zinc ornament, which may be the residue of a coating.
Sources:	Unknown



Pl. 38A

APPENDIX – B

METHODS OF ATTACHMENT OF A PICKET TO A RAIL

1. Forged directly from the bar with fullers, swages and a shouldering tool;

- This is a traditional blacksmithing solution that could have been performed at any time as it requires simple tooling within reach of any experienced blacksmith. Fullers, (veiner) and swages are used to draw out the tenon and a monkey tool for squaring the shoulders.[1] If the picket is too long, it can be reheated carefully so as not to burn the tenon or worked cold, using a monkey tool in either case to upset the shoulder. Any flaring from the upset can then be filed off. This kind of adjustment is evident on at least one of the enclosures in the cemetery, a case of careless work, where the flaring was not filed off. If the picket is too short, it can be stretched somewhat, even when cold, by hammering without leaving too obvious a mark.

2. With a prisoner rivet, (rivet head is "imprisoned" in a shallow hole drilled in the end of a bar);

- This is a detail of assembly used well before the nineteenth century. It is clearly seen employed on a damaged enclosure in the cemetery.[2] It requires the drilling a shallow hole, inserting a rivet, head first and then chasing adjacent metal to close the gap

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[1]Jack Andrews. *New Edge of the Anvil: a Resource for the Blacksmith*, Ocean Pines, MD: SkipJack Press, 1994, p. 57-58 and Alex W. Bealer, *The Art of Blacksmithing*, New York: Funk & Wagnalls, 1976, p.129

[2] This is the Fortstall, et al Tomb, THNOC # 199, hastily made or made by an inexperienced or careless fabricator with poor fitting and finish.

around the head. The advantage to this technique is that it could be accomplished easily without heating and with a minimum of drilling. It was strong enough in sheer and tension for this application, namely just holding in place parts that had no structural function.

3. With a dowel fastened by pinning in the predrilled end of a bar;

- This detail requires very precise drilling and the use of thin steel pins to hold and help tighten the assemblage with off-set holes.[3] The delicacy of this assembly makes it more appropriate for indoor applications. The technique was used in France in the seventeenth and eighteenth centuries for high quality work.[4]

4. With a dowel held by brazing in the predrilled end of a bar[5];

- Brazing is the assembly of two similar or dissimilar metals joined by another metal of lower melting point. Brazing of large pieces was performed in the forge using a clay shell to hold parts together probably before the nineteenth century. The brazing of smaller items requires a more controlled heating. Specially contrived torches were used in the nineteenth century for small items such as clockworks or locks, but would not have provided an intense enough heat for the efficient brazing of many dowels in a much larger relative volume of square stock. It is possible that brazing could have been performed with the heat of the forge or a smaller stove for a more controlled and

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[3] Raymond Lecoq, *Le Fer Forgée et Serrurerie*, Paris : Jean-Cyrille Godefroy, 1999, pp. 12-13
[4] Albert France-Lanord, L'Art de la Serrurerie au XVIIIe Siècle et Jean Lamour, In *Métiers d'Art*, Société d'Encouragement aux Métiers d'Art, No. 18/19, Avril 1982, p. 35
[5] Lecoq, *Le Fer Forgée et Serrurerie*, pp. 12-13

cleaner heat.[6] In any case, both pieces of iron to be joined must be fitted tightly and then brought to a red heat at the same time, which requires that the larger piece be preheated. Flux is applied to prevent oxidation before applying the brazing rod to the joint to be brazed. Brazing may not have been cost effective until the end of the century when natural and manufactured gases came into use. These produced an intense concentrated heat that could easily be directed where needed.

5. By turning a tenon from the bar on a lathe;

- Lathes were available in shops in New Orleans at the time, but this kind of very small machining for work in series would have been out of scale with industrial equipment, tying up machinery needed for more appropriate work.

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[6] Désormeaux, pp. 170-174

APPENDIX – C

JOSEPH LEHEC
BLACKSMITH, NEW ORLEANS, LA

A brass maker's plaque was found as a bolt-hole cover on the latch side gate post of the Dubreuil Tomb, THNOC # 573, in St. Louis Cemetery No.1 in New Orleans, stamped simply with the name "LEHEC". This is the only maker's mark discovered so far on any of the metalwork in the cemetery. The Dubreuil Tomb metalwork has a strong French influence designated in this study as "Louis XVI Revival". The following limited research was carried out on the name Lehec in the nineteenth century U.S. Census and City Directories for New Orleans:

CENSUS

United States Census for 1860, 2nd Ward, 1st District of the city of New Orleans, Orleans Parish, Louisiana, June 25, 1860, Sam Marshal Assistant Marshal, New Orleans Post Box [G.] 54, p. 194

Dwelling number: 843
Family number: 1732

Line 37:
Margaret Kating, age 36, female
Occupation: [blank]
Place of Birth: Ireland

Line 38:
Edward Kating, age 20, male
Occupation: Plasterer
Place of Birth: Ireland

Line 39:
Joseph Kating, age 18, male
Occupation: Plasterer
Place of Birth: Ireland

Line 40:
William Lehec, age 30, male
Occupation: Blacksmith
Place of Birth: Ireland

NEW ORLEANS DIRECTORIES

From Microfiche on file at the Williams Research Center, 410 Charters St., New Orleans, LA, (as labeled on microfiche):

1. New Orleans, LA, [Directory], 1851-1855, 1857, 1859
2. Cohen's New Orleans Directory, 1856
3. Kerr's Crescent City Directory for 1856
4. New Orleans, LA by Charles Gardener, 1858
5. A. Mygatt & Co., Mygatt's Business Directory 1858
6. Crescent City Directory, New Orleans, 1858-1859
7. Gardner's Commercial & Business Register 1860
8. Hellier's New Orleans Business Directory, 1860-61
9. New Orleans City Directory, 1860, 1861, 1866-1868

Note: There is only one entry with the family name of LEHEC in all the New Orleans city directories listed above. The directories prior to 1851 were not consulted. The directory is listed first by number:

1.	1851	Lehec, Joseph, 175 Ursulines
1.	1852	Lehec, Joseph, 175 Ursulines
1.	1853	Lehec, Joseph, 175 Ursulines
1.	1854	Lehec, J. 175 Ursulines
1.	1855	Lehec, J. 175 Ursulines (no Lehec in the business directory)
3.	1856	Lehec, J. Locksmith 175 Ursulines
2.	1856	Lehec, J. 175 Ursulines (p.155)
1.	1857	no entry [?]
5.	1858	Blacksmiths Lehec & Co., Ursuline bet. Burgundy & Rampart
7.	1858	Lehec, J., Blacksmith 175 Ursulines (p. 190)
6.	1858-59	No advertisement for Lehec & Co.
1.	1859	Lehec, J. 175 Ursulines
7.	1860	No entry for Lehec
9.	1860	Lehec, Joseph, 488 Bourbon, d. 3
9.	1861	Lehec, Joseph, 488 Bourbon, d. 3
8.	1860-61	No entry for Lehec
9.	1866	Lehec Joseph Mrs.138 Ursulines
9.	1867	Missing page
9.	1868	No entry for Lehec

Comments:

There is only one person listed in the 1860 census under the family name of LEHEC. No entries for a Lehec exist in either the 1850 or 1870 census for New Orleans. The Lehec in the 1860 census is listed as William just under a Joseph Kating and as a blacksmith. He is also specified as being born in Ireland. Given the record in

the city directories, listing only a Joseph Lehec, also a blacksmith, it is possible that the census taker inverted the names, where Joseph Kating should have been William Kating and William Lehec – Joseph Lehec. In addition, given the strong French influence in the design of the ironwork signed LEHEC in St. Louis Cemetery No. 1 and the Norman or Briton origin of the name Lehec, it may also be reasonable to assume that the census taker was also mistaken with regard to place of birth.

Joseph Lehec lived in New Orleans at least as early as 1851. If the age given in the census is accurate for William [read Joseph] Lehec at 30 years, he would have been 21 years old in 1851. His occupation is first listed as 'locksmith' in 1856, which is a direct translation of the French *serrurier*. *Serrurie* in France meant locksmithing, but could also include fine ornamental ironwork. By 1858, a 'Lehec & Co., Blacksmiths' is listed in Mygatt's Business Directory. Lehec has changed over to the Anglo-American designation of 'Blacksmith', which more accurately described his expertise in English, by this time the predominant language. His domicile is given as 175 Ursulines during the years 1851-1859. Additional research might determine if this is the same address as his business indicated as being between Burgundy and Rampart on Ursuline in 1858.

In 1860 Lehec apparently moved his domicile to 488 Bourbon, d. [door?] 3. The U.S. Census for that year unfortunately does not specify addresses to corroborate if this was the same location where the census was taken recording 'William' Lehec. Perhaps there is a way to trace the address with the Ward, District and dwelling number information.

There is no entry for his business in Hellier's New Orleans Business Directory of 1860-61. During the Civil War years of 1862 to 1865 no directories were published for New Orleans. The only subsequent listing for a Lehec is in 1866 for a Mrs. Joseph Lehec living at 138 Ursulines. This suggests that Joseph Lehec may have died before 1866, perhaps as a casualty of the war and leaving a widow.

APPENDIX – D

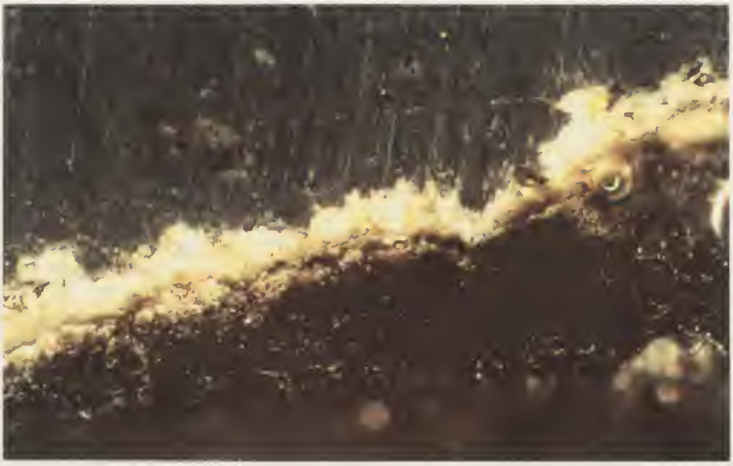
ANALYSIS OF METALS

ZINC SAMPLE

The sample was taken from the base of a cast zinc picket point cast directly on one of the round pickets of the Bernard de Marigny tomb, THNOC # 606. A metallographic section was mounted in epoxy. The final polish was obtained using a 1μ diamond abrasive in a liquid suspension on a rotating polishing cloth. This sample included a remnant of black paint. The photomicrographs were taken with 200 ASA Kodak color print film, using an inverted stage metallographic microscope.[7] The photomicrographs were taken first with the sample unetched, then etched in a water solution of chromium oxide and sodium sulphate.

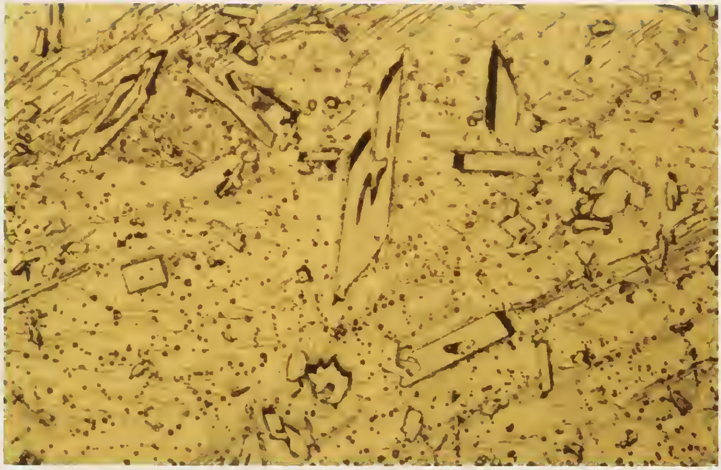
Zinc Picket Point section, 100X (unetched)
This view was taken at the edge of the sample. A layer of corrosion is barely evident under a layer of black paint.

[7] All micrographs were taken by the author courtesy of the Conservation Laboratory of the Philadelphia Museum of Art, under the guidance of Melissa Meighan and Andrew P. Lins, Director.



Zinc Picket Point section, 100X (unetched)
This is the same view as above, but in dark field with the corrosion layer much more clearly seen as a contrasting white line. Separation is evident between the corrosion layer and the paint.

Zinc Picket Point section, 200X (etched)
In this view, the etching reveals the layer of corrosion at the surface of the zinc and the inroads of corrosion between grain boundaries, (red arrow).



Zinc Picket Point section, 200X (etched)
This photo is taken at 250x and shows rhomboidal shapes on the surface, which are typical of iron-zinc compounds. These are harder than the zinc and stand proud of the surface after etching. The iron is a contaminant usually coming from the process of re-melting for casting where iron oxides enter the melt from a cast iron crucible, an iron ladle or cast iron mold and forms a compound with the zinc. The small round spots are embedded abrasive difficult to remove due to the softness of the metal. Many strain lines are present, but may also be discounted since these are easily caused by the mechanical action of the saw used to cut the sample.

This sample was etched in a water solution of chromium oxide and sodium sulphate. The etching was followed by a rinse of chromium oxide alone:

The etching was followed by a rinse of chromium oxide alone:

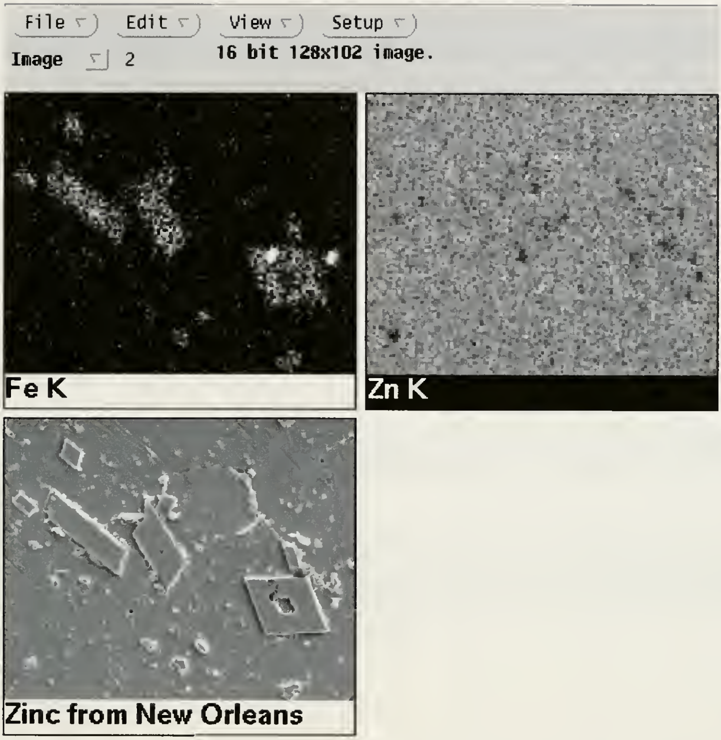
Solution "A":	40g	CrO_3	Solution "B":	40g	CrO_3
	3g	Na_2SO_4		200g	H_2O
	200g	H_2O			

Immerse in solution "A" with gentle agitation for several seconds, rinse in solution "B".[8]

[8] Leco Corp. *Metallography*, 1977 for metal etching formulae

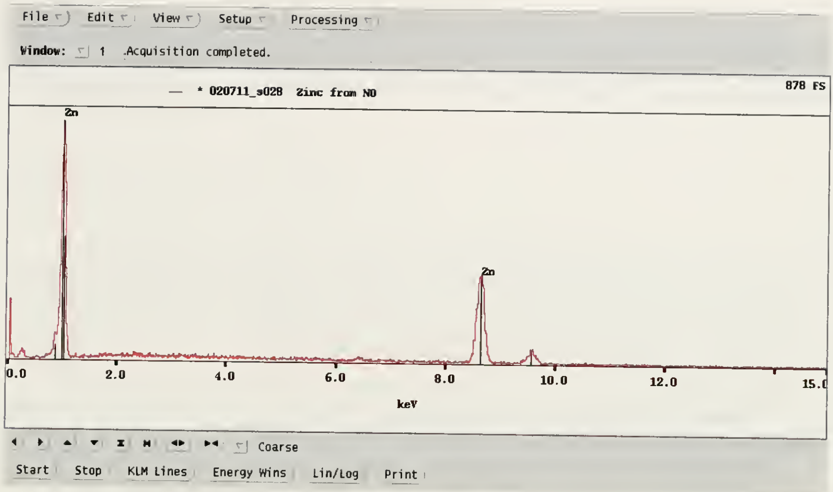
This is an image of the preceding sample from the Marigny tomb zinc picket point produced by a scanning electron microscope, (SEM) showing the surface of the zinc sample with greater relief.[9] The rhomboidal zinc-iron compounds ($FeZn_2$ or greater proportion of zinc are common), appear to be resting on the surface, but may extend down into the material.

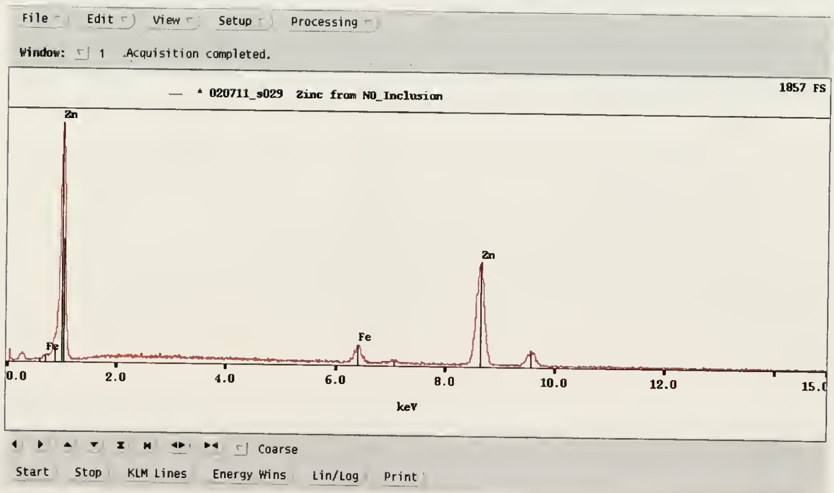
[9] This photograph was taken courtesy of Rohm and Haas, with the assistance of Dr. John Reffner, Senior Scientist, (R&H) and Dr. Kenneth Sutherland, scientist with the Philadelphia Museum of Art.



The upper two images are elemental scans for iron and zinc using energy dispersive spectroscopy, (EDS).[10] They are a graphic representation of detected radiation emitted from the sample after exposure to an electron beam. They should be compared to the SEM photograph below. The images can show relative concentrations and distribution of component elements. Zinc shows up as the base metal with a continuous presence. In the case of the iron, the representation has been enhanced to show distribution, which has exaggerated its relative concentration.

[10] These photographs were taken courtesy of Rohm and Haas, with the assistance of Dr. John Reffner, Senior Scientist, (R&H) and Dr. Kenneth Sutherland, scientist with the Philadelphia Museum of Art.





These are spectral graphs of the sample zinc sample from the Marigny Tomb recording detected energy levels emitted after exposure to radiation, (y = t in sec. and x= Energy levels).[11] Different energy levels correspond to a specific element. The upper graph represents the general filed of the sample clearly showing the overriding presence of zinc along with some "noise" or a mostly negligible presence of

[11] These graphs were produced courtesy of Rohm and Haas, with the assistance of Dr. John Reffner, Senior Scientist, (R&H) and Dr. Kenneth Sutherland, scientist with the Philadelphia Museum of Art.

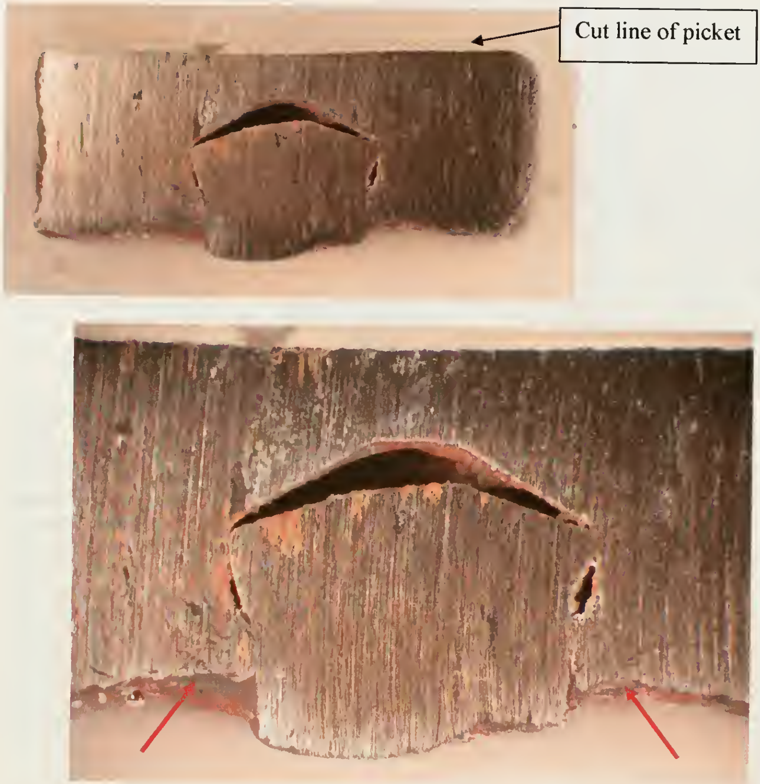
other elements. The lower graphs shows readings taken from the inclusion or the rhomboid shaped component in the SEM photograph, which registers a preponderance of zinc with a very small presence of iron at ≈ 6.3 keV. Returning to the upper graph of energy levels recorded from the general field, a very small bump shows up at the same level of 6.3, confirming the presence of iron - the concentration of iron being in the rhomboid inclusion.

Conclusions for the Zinc Sample

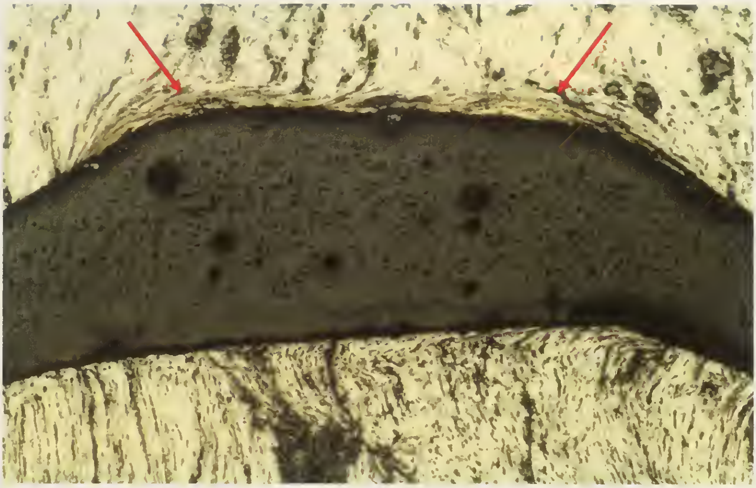
This single sample of zinc from the cemetery cannot be used to make generalized statements about the zinc found throughout the cemetery. The zinc used for the picket point on the Marigny tomb was probably initially very pure and was contaminated with very small amounts of iron oxide from the casting process. The usual trace elements of lead and cadmium were not evident in the spectral analysis.

The picket was protected at some point with a coat of black paint, which had failed and allowed corrosion to form on the surface. The corrosion also extends between grain boundaries which could be leading to a mechanical separation of grains near the surface and the steady progression of erosion of the zinc. Little can be discerned concerning the original structure of the casting because of subsequent deformation and the propensity for zinc to recrystallize at very low temperatures.

WROUGHT IRON SAMPLE



Wrought Iron prisoner rivet longitudinal section, 10x (unetched)
This section is taken from the bottom end of a picket on the Marigny Tomb #606 where the picket is fastened to the bottom rail of the enclosure. The rivet head survives in the hole drilled for it and the metal from the round picket bar is seen chased tight around the head, (red arrows).

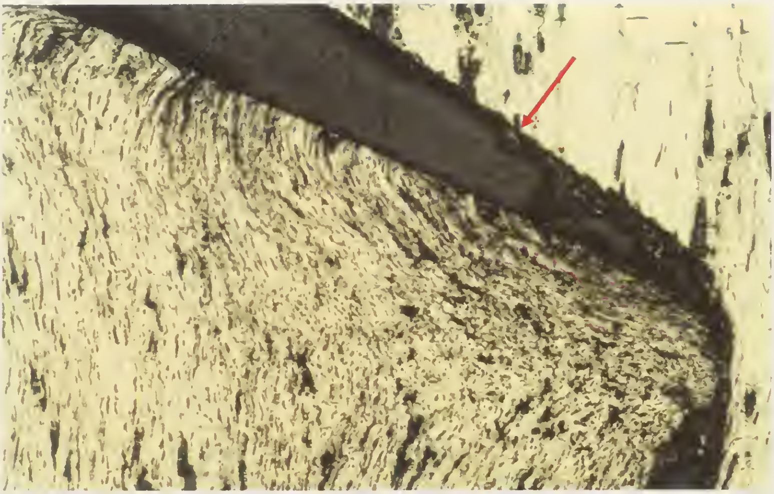


Wrought Iron prisoner rivet longitudinal section, 50x (etched)
This is a close up view of the gap between the rivet head, below and the bottom of the hole drilled into the picket end, above. What is readily seen under the microscope and to a lesser degree with this photomicrograph is that the ferrite grains of the picket above are quite large and almost equiaxed, whereas those of the rivet are much smaller and more distorted. The slag stringers in the picket section are generally larger and sparser, whereas those in the rivet are smaller and closer together. This can be explained by the fact that the rivet had to be subjected to more passes through a set of roller dies and at lower temperatures than the larger diameter round picket bar. The greater degree of working in the rivet stock broke up the grains and slag and compressed them more. In addition, the picket end was mostly only subject to the cutting action of the drill bit severing the grains and slag stringers, whereas the rivet received cold working from the formation of the rivet head, which further distorted the slag stringers and grains. Some distortion of the slag and grains can be seen along the edge of the flat bottom of the hole. This is due to the configuration of the drill bit which was probably forged and hand ground. The beveled side edges of the bit were ground to perform a cutting action on the side, while the flat tip of the bit did not have the same cutting edge and performed more of a wearing action on the bottom of the hole dragging the slag and ferrite grain with it in a circular pattern, (see red arrows).

All wrought iron metallographic samples were mounted in epoxy. The final polish was obtained using a 1μ diamond abrasive in an oil suspension on a rotating polishing cloth. The photomicrographs were taken with 200 ASA Kodak color print film, using an inverted stage metallographic microscope.[12]

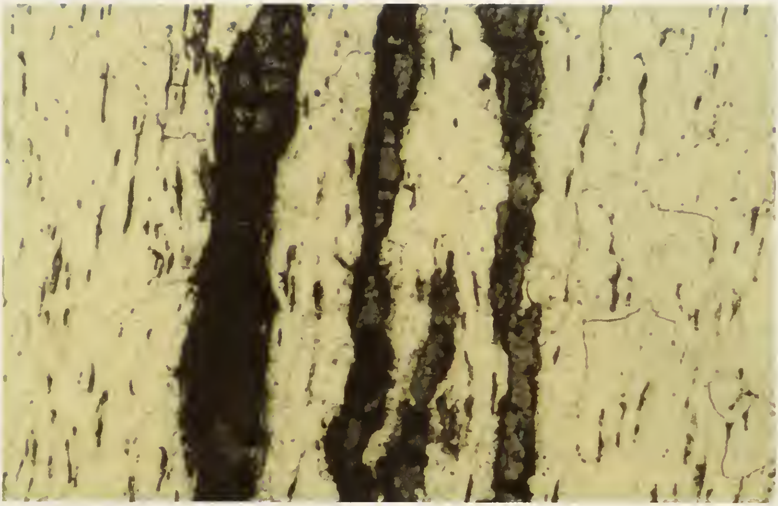
The samples were all etched in a solution of 2% Nital, made of 2 ml of Nitric Acid and 98 ml of Ethanol.

[12] All micrographs were taken by the author courtesy of the Conservation Laboratory of the Philadelphia Museum of Art, under the guidance of Melissa Meighan and Andrew P. Lins, Director.



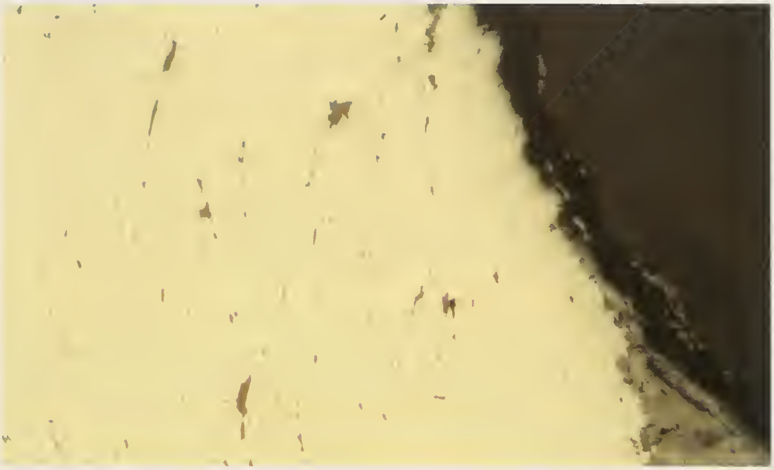
Wrought Iron prisoner rivet longitudinal section, 50x (etched 45s)
This view shows the right hand side of the same rivet head. The shearing of the slag and grains of the picket by the drill bit can be clearly seen above right, (red arrow). The edge of the rivet head shows the greatest amount of distortion from cold working.

Wrought Iron rivet longitudinal section, 50x (unetched)
This unetched view of the fractured rivet end shows the remnants of large slag inclusions, (red arrows), which could have been the cause of the failure of the rivet. The excessive size of the slag could have led to a structural weakening of the small diameter rivet. This may have been aggravated by the cold work of heading the rivet on the opposite end and possibly also by a nick in the side of the rivet from the cape chisel used to chase the metal around the head, (at right).

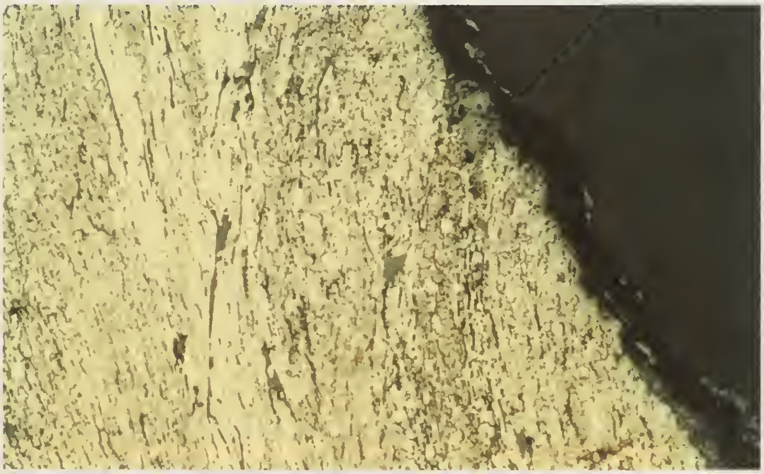


Wrought Iron longitudinal section of picket, 200x (etched 45s)
The large grains of ferrite show a small distortion in the axis of the bars in the same direction of the slag stringers showing up as two or three phased dark lines in the middle of the photograph.

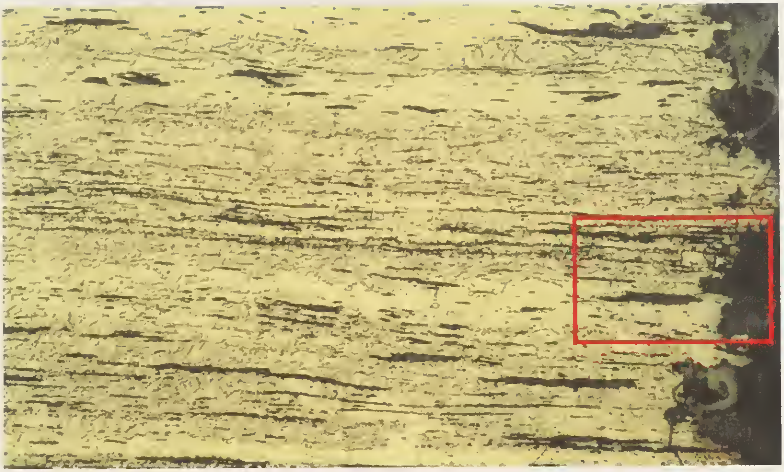
Wrought Iron picket longitudinal section, 500x (etched)
This large magnification shows the ferrite grain boundaries of the picket slightly deformed in the axis of the bar as are the siliceous slag inclusions. Small round inclusions, (red circle), seen within the grains may be manganese sulphide. These are harder and do not deform as readily as ferrite and slag.



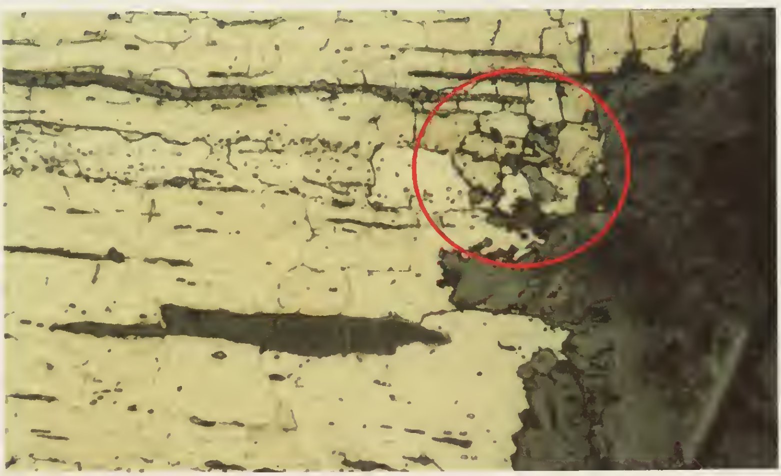
Wrought Iron handrail cross section, 50x (unetched)
This is a section of wrought iron handrail from the Dubrueil Tomb THNOC #573 showing the distortion of the slag stringers from the hot forging of a cavetto type molding on the top edge of the bar, (concavity seen on right). Corrosion is seen at the lower right corner.



Wrought Iron handrail cross section, 50x (etched 55s)
Etching caused some flash rusting obscuring the picture, but the grey cross section of the stringers can still be seen squashed from forging and conforming somewhat to the curvature of the molding.



Wrought Iron handrail longitudinal section, 50x (etched 55s)
This view shows the typical fibrous aspect of wrought iron with acicular slag stringers stretched out in the axis of the bar in a matrix of ferrite.



Wrought Iron handrail longitudinal section, 200x (etched 55s)
This photograph is a magnification of the section outlined in the red rectangle above. Etching has revealed the ferrite grain boundaries at the end of the forged handrail with some variation in grain size possibly due to partial annealing. The slag and corrosion products look similar in bright field lighting. It is difficult to distinguish between slag inclusions and intergranular corrosion, (red circle).

Conclusions for the Wrought Iron Samples

All the iron sampled shows the glass-like siliceous slag fibers entrained in a high purity iron base metal, (ferrite), which is what characterizes wrought iron.[13] Two phases show up in the slag: typically wüstite (FeO) as rounded dendritic shapes in a glassy matrix.[14] The wrought iron picket and handrail both appear very similar in composition with mostly the same grain size and configuration, distribution and size of slag. The handrail show more variation in grain size due to additional forging.

The amount of slag corresponds to what was normally produced through the puddling process, produced in a reverbatory furnace, which was first successfully commercialized toward the end of the eighteenth century. The 3/16" diameter rivet stock was produced the same way, but had to endured greater stresses through repeated reduction in size by rolling. The proportion of slag in the rivet stock may have been too much for use in riveting, where high degree homogeneity in the material is necessary for structural integrity.

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[13] James Aston, *Wrought Iron: Its manufacture, characteristics and applications*, Pittsburg, PA: A. M. Byers Co., 9th printing, 1952, p. 2

[14] David A. Scott, *Metallography and Microstructure of Ancient and Historic Metals*, Singapore: Tien Wah Press, J. Paul Getty Trust, 1991, p. 89

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